T & W

3D DRAFTING SYSTEM

DESIGNER'S REFERENCE MANUAL

RELEASE 1.0

JULY 1983

CAD DIVISION
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7372 PRINCE DRIVE #106
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Welcome to CADAPPLE version 3.0.

IF YOU ARE NEW TO CADAPPLE, we suggest that you take the following approach to setting up your new system. Start with the Installation Manual and set up your system as described. Regardless of your intended final configuration, we recommend that you set up your CADAPPLE system initially to run on two floppy drives and run it for a short time in this configuration until you are satisfied that all the components are operational.

When your hardware is set up and your system is working, you might want to work through the Tutorial section of the Application Notes to become familiar with the basic operation of the drafting system. If your final configuration will include a RAMdisk or a Corvus hard disk, you need to become familiar with the Pascal system Filer before you set up these disks. An outline of the most frequently used commands is included in the Application Notes. When you are fairly comfortable using the system Filer and the ENVIRO program, you should set up your final configuration. If you follow this stepwise approach, you will have a working system from the beginning and you will be able to make informed judgements regarding your final configuration..

IF YOU ARE AN EXPERIENCED CADAPPLE USER, you should take a few minutes to familiarize yourself with the many new features and the configuration changes of this version.

Major changes have been made in the programs and files of the CADAPPLE system for version 3.0. For that reason, do not mix the diskettes of version 3.0 with the diskettes of any previous version. To access your drawings produced under version 2.7 of the software, it will be necessary to run the conversion program as outlined on the accompanying Application note. Once you have converted your drawings, we recommend that you remove all copies of old 2.7 drawings and any previous version of the software from your work area to avoid any confusion.

Please skim through the Installation Manual paying particular attention to switch settings for plotters and cable configurations. The boot-up and procedure for executing the 2D program have been changed. The instructions are in the Installation Manual.

The following programs have had major changes:

ENVIRO30 -- the environment configuration program. Note that many of the programs and files of version 3.0 have the version number appended to the file name. There are a number of new features in this program so please take a few minutes to look briefly at the Enviro Manual to understand the new treatment of plotters, Booster cards, Two screen systems, and additional disk drives. The new arrangement of the file volumes is also shown.

2D30 -- the main drafting program codefile. The following sections of the Reference Manual are either new or changed:

3.2 ADD
- 3.2.11 pOint
- 3.2.14 Group
- 3.2.15 Update properties

3.3 MODIFY
- 3.3.4 Copy
- 3.3.14 object Properties

3.4 OBJECT PROPERTIES
- 3.4.14 Marker
- 3.4.17 Update properties

3.5 GROUP
- 3.5.4 Copy
- 3.5.13 group Properties
- 3.5.14 Find

3.6 GROUP PROPERTIES
- 3.6.13 Marker
- 3.6.16 Update properties

3.7 FILER
- 3.7.3 Get
- 3.7.5 Merge

3.8 UNITS
- 3.8.7 Rotation
- 3.8.8 library Factor

3.10 SWITCHES
- 3.10.4 Marker
- 3.10.8 Hatch
- 3.11.11 Levels

3.11 LEVELS

3.13 LIBRARY

3.14 GROUP

3.15 HATCH

3.16 INQUIRE

3.18 OUTPUT
- 3.18.3 Plotter

Several new sections have been added to the Application Notes. Note especially the new 'Problems and Solutions', special programs for installation of speed-up devices, and instructions for loading a Corvus hard disk.

We hope that the CADAPPLE version 3.0 software will provide you long and dependable service.

Sincerely,

Chris Stammen
CADAPPLE Product Manager

CADAPPLE

2D DRAFTING SYSTEM

INSTALLATION MANUAL

RELEASE 3.0

JANUARY 1984

CADAPPLE DIVISION
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1. INTRODUCTION

This manual includes complete instructions for assembling and installing your 2D Drafting system. It is divided into sections that include installing peripheral cards in the computer, arranging your hardware, programs, and files for efficient operation, making backup copies of your Master diskettes, and starting up the 2D drafting program. It assumes that you have had no previous experience with computers.

As you are using this manual, you should also refer to the instructions supplied by the manufacturer of each piece of equipment.

Before you begin this installation, you should have the following at hand:

At least one box of 10 blank diskettes -- single side, double density, soft sectored, certified 40 track. We recommend:
Verbatim MD 525-01-18158 Datalife
Diskette labels
A felt-tip pen

If you are assembling your computer hardware for the first time, please allow approximately two hours.

2. HARDWARE AND OPERATING SYSTEM OVERVIEW

The system is a computer-aided drafting (CAD) package designed to run on APPLE II computers. The hardware configuration has many options to meet specific needs but generally includes:

Apple II computer with 64K bytes of memory, two 5 1/4" disk drives, a joystick or digitizer for input, a plotter for output, and a speed-up device such as a co-processor or a RAM disk.

The system runs under Apple Pascal version 1.1 operating system. A runtime version of this operating system including a disk formatter and a filer is included with the drafting package. Some knowledge of the Apple Pascal operating system is helpful in using the drafting system. A brief outline of the most commonly used features is provided in the Application notes. For more information on the Apple Pascal operating system, we recommend the following document:

Apple Pascal Operating System Reference Manual
Apple product # A2L0028 (030-0100-00)

3. DRAFTING PROGRAM OVERVIEW

The 2D drafting system is used to create a symbolic drawing on a graphics screen using a digitizer or joystick for input and for editing the drawing, and an X-Y plotter for placing the drawing on bond, vellum or mylar. The drafting system can be used to create libraries of commonly used symbols or parts of drawings. As new drawings are created, the symbols stored in the libraries can be brought onto the new drawing quickly and easily.

3.1 DOCUMENT ABSTRACTS

The drafting system software package contains the necessary manuals and diskettes. A brief abstract of each is given below.

Installation and Startup Procedures Manual

This is the manual that you are currently reading. It contains instructions for unpacking and setting up your hardware and software. It explains how to install the required peripheral cards. It also provides detailed instructions for making backup copies of your Master diskettes. Please read this manual first.

Environment Configuration Manual

The Environment configuration manual gives a detailed explanation of how the ENVIRO program is used. This ENVIRO program creates a file that tells the drafting system what kind of input device you are using (joystick or digitizer), what size plotter, and other configuration information. The system is shipped with the ENVIRO set to the most common configuration for a two drive system. However, you should at least check this configuration before running the 2D drafting system.

Designer's Reference Manual

This manual gives a detailed explanation of all the functions and capabilities of the system. If the designer has any questions about what the system can do or how to do it, he should refer to this manual.

Application Notes

The Application Notes includes among other topics: a complete Tutorial with exercises to guide the beginning user in starting to use the system; various notes, including information submitted by users, on ways of using the system for increased efficiency; a Problems and Solutions section for solving many of the most common problems encountered in using the system.

3.2 DISKETTE ABSTRACTS

The diskettes you received contain the codefiles and datafiles required by the drafting system. They also contain the parts of the Apple Pascal Operating System required to boot the computer, to format new diskettes, and to maintain the system files. The 2D object code has been expecially designed to run only on an APPLE II Computer (or APPLE II-compatible computer) with at least two disk drives. The object code will not run on any other machine.

The files on each diskette are listed below:

'BOOT' diskette:

SYSTEM.LIBRARY	The PASCAL library of user callable routines
SYSTEM.APPLE	The PASCAL p-code interpreter
SYSTEM.PASCAL	The PASCAL system main program
SYSTEM.FILER	The PASCAL file organizer
SYSTEM.MISCINFO	The PASCAL configuration datafile
FORMAT.CODE	Program for formatting new diskettes
FORMATTER.DATA	Datafile used by the format program
CONV2.7.CODE	Program to convert version 2.7 drawing files to version 3.0 drawing file format
ENVIR030.CODE	Program for changing drafting environment
ENVIR030.DATA	Datafile that stores drafting environment

'CODE' diskette

PSTROKES30.DATA	Data file for plotter graphics text
SSTROKES30.DATA	Data file for screen graphics text
2D30.CODE	Object code of drafting program

'WORK' diskette

SYSTEM.LIBRARY	The PASCAL library of user callable routines.
MENU30.DATA	Data file for 2D program menus
MESS30.DATA	Data file for 2D program messages
HATCH30.DATA	Datafile used to create cross-hatching
LIB30.DATA	Datafile used to maintain the libraries
2D30.WRK.DATA	Workfile for drafting program (automatically created if not present)

'HELP' diskette

HELP30.DATA	HELP messages for drafting program

You will notice the file SYSTEM.LIBRARY on both the 'BOOT' disk and the 'WORK' disk. If you are using a standard two drive system, this file must remain on this diskette. The position of this file must also remain the same.

If you plan to use only two standard 5 1/4" drives with your system, then please follow the organization of the diskettes as they are supplied. Do not transfer files around thinking that you might gain some extra space. The program has grown quite large and there are not many configurations possible that will run on a two drive system. The largest workfile that you can make on a two drive system is 1100 objects.

If you have a hard disk, AXLON RAMdisk or higher density floppy disk drives, you may wish to experiment with different configurations. See the suggested configurations in the Application notes.

1100 OBJECTS
LARGEST
WORKFILE

4. BASIC HARDWARE CONFIGURATION

The hardware for your system was selected to suit your particular needs. As you unpack your system components, you should refer to the packing list provided with your system to be sure that all the parts are included. This list will also help you to identify the various components by name.

Your system will generally include the following hardware:

- Apple II plus computer with 64K
  or Apple IIe computer
- Two Apple Disk II 5 1/4 inch disk drives with controller
- Monitor
- Input device
  Joystick
  or Houston Instruments HIPAD digitizer (Model DT11)
- Output device
  Houston Instruments plotter
  or Hewlett Packard plotter
- Asynchronous Serial interface card for plotter
  California computer Systems-7710-01 card
  or Apple Super Serial card

Other compatible hardware:

- Axlon RAMdisk
- Speed-up devices
  The MILL
  or The VITAMILL
  or Accelerator II (6502C card)
  or The Hustler (6502C card)
- Dot matrix printer
- Grappler interface card for dot matrix printer
- Hard disk and networking devices
  Corvus single user
  or Corvus Omninet

5. PERIPHERAL CARD INSTALLATION

5.1 GENERAL PRECAUTIONS AND INSTRUCTIONS

The following general precautions should be observed when installing any interface cards in your computer.

BEFORE YOU BEGIN, BE SURE THAT THE POWER TO THE COMPUTER IS OFF.

Moving cards in the computer while the power is on can damage both the card itself and the computer. It is best to have the computer plugged into an electrical wall outlet so it is grounded but the power switch must be OFF.

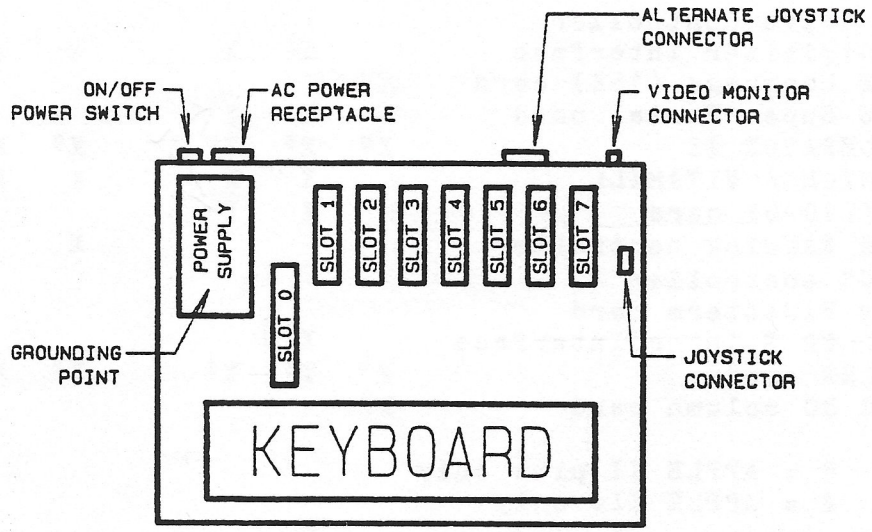
Always ground yourself before you handle an interface card or integrated circuits. It is a good practice to ground yourself by touching one of the metal screws on the underside of the Apple keyboard or by touching the Apple power supply inside the computer.

Follow the instructions provided by the manufacturer of each card for connecting cables to the card. In particular, be sure to align pin 1 of the cable connector with pin 1 of the mating connector on the card.

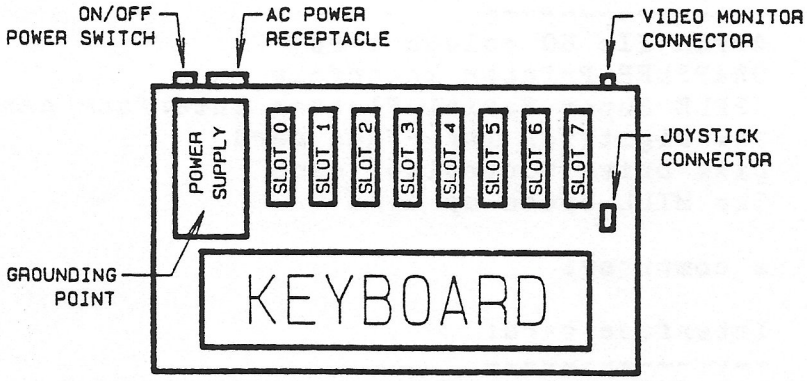
Handle all interface cards carefully. Try to handle cards by the edges and be careful not to crush delicate components. Attach required cables and set switches before you install the card in th slot. To install the card, hold the card by the top edge with the component side of the card facing away from the power supply. Align the gold finger connector on the card with the appropriate 50-pin slot on the system board of the computer and gently push the card down into the slot. Arrange any connecting cable to extend neatly through one of the openings in the rear panel.

5.2 OPENING THE COMPUTER

The interface cards are installed in slots inside the computer. To remove the cover, pull up on the rear edge of the computer until the two corner fasteners pop apart. Without lifting it any further, slide the cover backwards (away from the keyboard). The basic parts of the computer are shown in the diagram below. Note the differences in the slot arrangements between the APPLE II plus and the APPLE IIe especially the position of slot 0.



APPLE][e COMPUTER



APPLE][COMPUTER

5.3 DETERMINING A PERIPHERAL CARD'S SLOT NUMBER

Several of the interface cards must be installed in specific slots; for others, slot assignment is optional. The following table lists the interface cards that may be used with the drafting system and their slot assignments (X marks a slot that may be used).

Card / Slot #	0	1	2	3	4	5	6	7
Disk Drive Controller							X	
T&W Digitizer Interface		X	X		X	X		X
APPLE Language (16K) card	X*							
APPLE Super Serial card		X	X					
ACCELERATOR II	X*	X*	X*		X*	X*		X*
THE MILL / VITAMILL		X	X		X	X		X
CCS-7710-01 card		X	X					
AXLON RAMdisk controller					X			
CORVUS controller							X	
Videx Videoterm card				X				
GRAPPLER Printer Interface		X						
HUSTLER card	X*	X*	X*		X*	X*		X*
APPLE 80 column card	X#							

Key: * = APPLE II plus only
= APPLE IIe only

In examining this table, it is clear that there are many possible ways of arranging interface cards. If you have cards for other applications, you may have to give some thought as to how you will arrange them to get all the cards in appropriate slots. The following configurations are provided as examples.

Apple IIe computer:

Slot #	Interface card:
0	APPLE IIe 80 column card
1	GRAPPLER Printer Interface card
2	APPLE Super Serial Plotter Interface card
4	T&W Digitizer Interface card
6	Disk Drive Controller card
7	The MILL Speed-up card

Apple II plus computer:

Slot #	Interface card:
0	ACCELERATOR II speed-up card
1	T&W Digitizer Interface card
2	CCS-7710-01 Plotter Interface card
3	Videx Videoterm 80 column card
4	Axlon RAMdisk Interface card
6	Disk Drive Controller card

We suggest that you stop at this point and select the appropriate slot for each interface card in your system using the table above to guide you. You should use the following chart to plan your configuration so that you have a written record as you proceed through this installation. You might also want to write down the configuration of your system before you start.

INTERFACE CARD SLOT ASSIGNMENTS:

	Before installing CAD System	After installing CAD System
slot 0	LANGUAGE CARD OR RAM CARD - 80COL CARD	slot 0
1	THW DIGITIZER INTERFACE	1
2	CCS-7710-01 CARD OR SSC CARD	2
3	EMPTY	3
4	MOUSE	4
5	THE MILL	5
6	DISK DRIVE CONTROLLER	6
7	HARD DISK	7

PLOTTER

5.4 INSTALLATION PROCEDURES

5.4.1 APPLE II DISK DRIVE INTERFACE CARD

This card is supplied with APPLE II Disk Drives. Using the instructions provided by the manufacturer, attach the cables from drive #1 and drive #2 to the corresponding connectors on the card. Be especially careful to align pin 1 on the card with pin 1 of the cable connector for each drive. Install this interface card in slot 6 of the computer.

5.4.2 APPLE II LANGUAGE (16K) CARD

This card is used to add an additional 16K bytes of memory to an APPLE II Plus computer to bring the total memory to 64K bytes. To install this card, follow the manufacturer's instructions for removing the appropriate memory chip from the system board of the computer. Install this card in slot 0.

5.4.3 T & W DIGITIZER INTERFACE CARD

This card provides the interface for the digitizer. THIS CARD MUST BE IN THE COMPUTER IN ORDER TO RUN THE 2D DRAFTING PROGRAM. Arrange the flat cable provided so that it will protrude through one of the openings in the back panel of the computer then attach it to the mating connector on the top of the card. Align pin 1 on the card connector with the red stripe on the cable. Be sure that all 26 holes are aligned with their respective pins and press the cable connector onto the card. Install the card in the appropriate slot.

5.4.4 T & W GAME I/O SECURITY BOARD

THIS SECURITY BOARD MUST BE INSTALLED IN THE COMPUTER IN ORDER TO RUN THE 2D DRAFTING PROGRAM. Locate the game I/O socket on the motherboard of the computer. This socket is located just below and to the right of slot #7. Align pin #1 of the socket on the security board with pin #1 of the game I/O socket. Carefully press the security board into the game I/O socket. The security board should stand above the game I/O socket to avoid contact with other components. When the security board is correctly installed, the board should extend towards the right side of the computer.

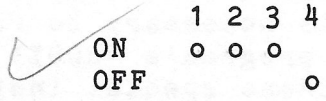
5.4.5 ASYNCHRONOUS SERIAL INTERFACE CARD

To use a plotter as an output device, you must have one of two asynchronous serial interface cards installed in the computer:

California Computer System Model CCS-7710-01 Serial Interface card or the APPLE Super Serial card.

5.4.5.1 CALIFORNIA COMPUTER SYSTEMS CCS-7710-01

Before you install your CCS-7710 card, you must configure the dip switches. The switches are in the upper right-hand corner of the card. Set them as follows:

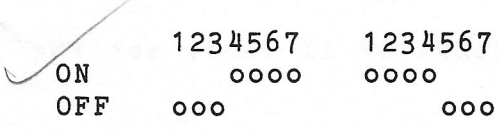


Arrange the flat connector cable so that it will protrude through one of the openings in the back panel of the computer then attach it to the mating connector on the card. Be sure to align pin 1 on the card with the appropriate hole on the cable connector following the manufacturer's instructions.

Recheck the switch settings and the cable connection then install the card in the appropriate slot.

5.4.5.2 APPLE SUPER SERIAL CARD

Before you install your APPLE Super Serial card, configure the dip switches and check the position of the jumper plug. The switches are in the upper left-hand corner of the card. Set them as follows:



The white triangle on the jumper block must point down (TERMINAL). If it does not, carefully pull the block out of the socket, turn it around and replace it.

Arrange the flat connector cable so that it will protrude through one of the openings in the back panel of the computer then attach the cable connector to the mating connector on the card. Be sure to align pin 1 on the card with the appropriate hole on the cable connector following the manufacturer's instructions.

Recheck the switch settings and the cable connection then install the card in the appropriate slot.

5.4.6 SPEED-UP OPTIONS

The following cards increase the speed of the drafting program. They generally consist of a coprocessor that speeds up the arithmetic functions in the program or a RAMdisk that increases the computer's transfer rate to and from external mass storage.

5.4.6.1 THE MILL / THE VITAMILL

The MILL and the VITAMILL cards have no connecting cables and no dip switches to set. These cards are compatible with both the Apple II and the APPLE IIe computers and with Corvus Omninet.

Install the card in the appropriate slot in the computer. When all the hardware has been set up, it is necessary to run an installation program to modify the 2D program's 'BOOT' disk to utilize this card. Instructions for these special installation programs are in the Applicatioin notes.

5.4.6.2 ACCELERATOR II

This card is compatible with the APPLE II Plus computer only and cannot be used in an APPLE IIe computer. This card also cannot be used with any DMA device such as CORVUS Omninet interface card.

This card contains additional memory and can be used in place of the APPLE Language card in slot 0 if desired. When the card is installed, its location should be indicated in the ENVIRO program. If the ACCELERATOR II card is used in slot 1 through 7, it is also necessary to run the ACCELERATOR installation program to modify the 2D program's 'BOOT' disk to utilize the card. Instructions for this special installation program are included in the Application notes.

Before you install the ACCELERATOR II card, set the dip switches as follows:

```
          1 2 3 4 5 6 7 8
ON        o o o       o o
OFF           o o o
```

Install the card in the desired slot in the computer.

5.4.6.3 HUSTLER

The HUSTLER card is a replacement processor for the APPLE II plus computer. This card is not compatible with the APPLE IIe. It is compatible with the Corvus Omninet interface.

Refer to the Technical Manual supplied with this card for installation instructions.

5.4.6.4 AXLON RAMDISK

The AXLON RAMDISK is an external mass storage device consisting of RAM chips that is used like a disk drive. Since all data on this device is lost if power is turned off for more than a few hours, device must be used with floppy disk drives to be able to permanently store the programs and files on the floppy disks.

Refer to the manufacturer's instructions for attaching the cable. Install the card in slot 4. Instructions for preparing an AXLON 'BOOT' disk are included in the Application manual.

5.4.7 OTHER INTERFACE CARDS

5.4.7.1 GRAPPLER

This card allows you to print the drawing currently displayed by the 2D program on a dot matrix printer. You must use the GRAPPLER card designed to work with your printer. Install this card in slot 1 according to the manufacturer's instructions.

5.4.7.2 VIDEX VIDEOTERM 80 COLUMN CARD

This card provides the interface for an optional second monitor which can be used to display the menus and messages. If this card is in the computer, it must be connected by cable with a second monitor in order to be able to see the menus and messages of the drafting program. This card must NOT be used with the soft switch device installed on the system board. Install this card in slot 3.

Connect the small Molex connector on the cable with the mating connector on the upper left hand side of the card. Arrange this cable to protrude through one of the openings in the rear panel. The video cable for the second monitor plugs into the round connector on the other end of the Videx cable.

When you are using the drafting system, one monitor must be connected with the standard video output jack built into the rear of the computer. This monitor displays the drawing.

5.4.8 JOYSTICK INSTALLATION

There are two types of joystick interface connectors for use used with APPLE IIe computers: one has a standard rectangular 16 pin game I/O connector; the other, the APPLE IIe joystick, has a trapezoidal 9 pin connector.

The standard rectangular 16 pin connector plugs into the socket on the T & W game I/O security board inside the computer. This device is located just below and to the right of peripheral card slot #7 and is installed in the Apple's game I/O socket. Align pin 1 of the connector on the joystick cable with pin 1 of the socket on the T & W game I/O security board and carefully insert the joystick connector.

If you are using an APPLE IIe joystick, connect the 9 pin connector with the mating socket on the back of the computer following the manufacturer's instructions. Note: you cannot have joysticks plugged into both the 16 pin and the 9 pin connectors at the same time.

6. PLOTTERS

The drafting program is interfaced with the plotters using the following protocol: RS-232-C communication, 9600 baud, 8 data bits, no parity, and 1 stop bit. The plotter is connected to the Asynchronous Serial Interface card in the computer by way of a cable.

The following plotters are supported by the 2D Drafting program:

Houston Instruments:
Models DMP-3, DMP-4, DMP-5, DMP-6, DMP-7, DMP-29, DMP-40, DMP-41, and DMP-42.

Hewlett Packard:
Models 7470A, 7475A, 7580A/B, and 7585A/B.

Tektronixs: Model 4662

Iwatsu: Model SR-6602

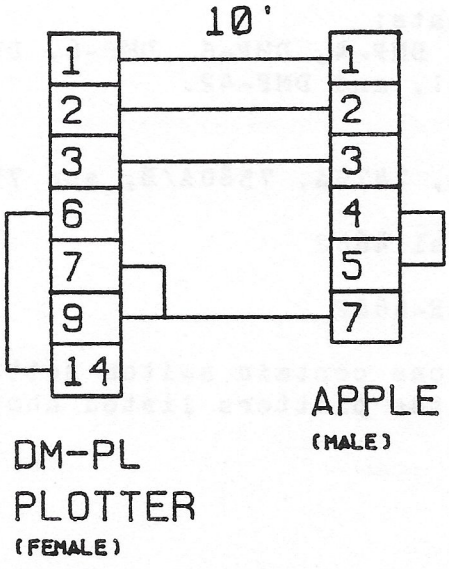
The following sections contain switch settings and cable configurations for the plotters listed above.

6.1 HOUSTON INSTRUMENTS PLOTTERS

6.1.1 Houston Instruments DMP-3, DMP-4, DMP-6, and DMP-7:

There are no switches to set on these plotters. You should press the 'RESET' button each time the plotter is powered up.

The cable configuration for these plotters is as follows:



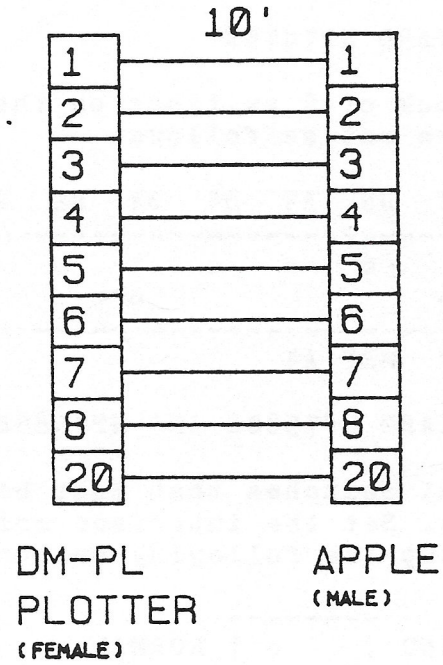
6.1.2 Houston Instruments DMP-29, DMP-40, DMP-41 and DMP-42:

There is one block of 8 switches on the back side of the DMP-29 plotter. They are set as follows:

```
                1 2 3 4 5 6 7 8
CLOSED          o     o o o o o     (closed = flush at the top)
  OPEN            o o
```

There are no switches on DMP-40, DMP-41, and DMP-42 plotters. You must set the baud rate each time these plotters are powered up using the keys on the front panel. Set the baud rate to 9600 by pressing the [ENTER] key followed by the [UP-ARROW] key.

The cable configuration for these plotters is as follows:



ENTER (+) UP ARROW = TOP SPEED
BAUD RATE = 9600

6.2 HEWLETT PACKARD PLOTTERS

Each of the Hewlett Packard plotters must be equipped with an asynchronous serial interface.

6.2.1 HEWLETT PACKARD HP7470A

There is one block of 8 switches on the rear side of the HP7470A plotter. They are set as follows:

```
 S2  S1   Y  US  B4  B3  B2  B1
-------------------------------
|          o   o       o     |   1
| o   o   o       o       o  |   0
-------------------------------
          D  A4
```

6.2.2 HEWLETT PACKARD HP7475A

There is one block of 9 switches on the rear side of the HP7475A plotter. They are set as follows:

```
 S2  S1   Y  US  A3  B4  B3  B2  B1
-----------------------------------
|          o   o   o       o     |   1
| o   o   o               o    o |   0
-----------------------------------
          D  MET A4
```

6.2.3 HEWLETT PACKARD HP7580B AND HP7585B

There are several switches that must be set on the HP7580B and HP7585B plotters. Set the interface mode switch to the RS-232-C position and setup the following switches:

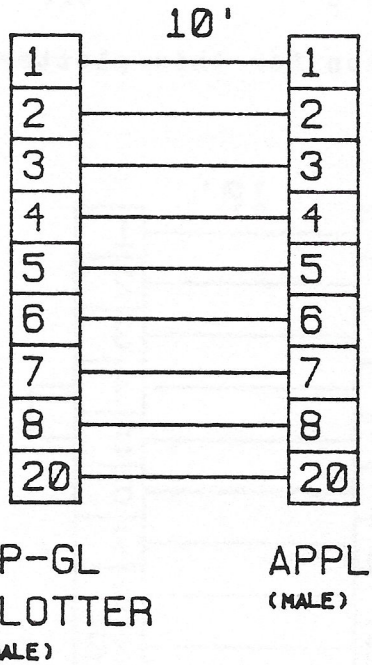
```
                --------
      EXPAND    |     o | NORMAL
    EMULATE     |     o | NORMAL
STAND ALONE     | o     | EAVESDROP
MONITOR MODE    |     o | NORMAL
      LOCAL     |     o | NORMAL
                --------
```

In the RS-232-C section, set the rotary baud rate switch to the 9600 baud position and setup the following switches:

```
                --------
  PARITY-ON     |     o | OFF
       EVEN     |     o | ODD
DUPLEX HALF     | o     | FULL
   HARDWIRE     | o     | MODEM
 DTR-BYPASS     |     o | NORMAL
                --------
```

6.2.4 HEWLETT PACKARD CABLE CONFIGURATION

All of the Hewlett Packard plotters use the following cable configuration:



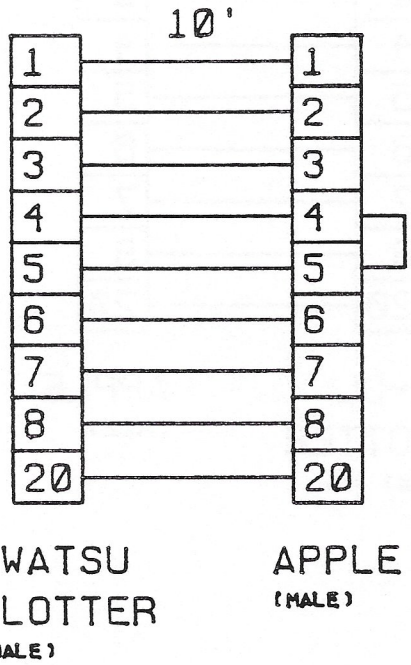
6.3 IWATSU PLOTTER

There are two blocks of 6 switches on the back side of the SR-6602 plotter. They are set as follows:

SW1:	1	2	3	4	5	6
ON	o					
OFF		o	o	o	o	o

SW2:	1	2	3	4	5	6
ON	o	o			o	
OFF			o	o		o

The cable configuration for this plotter is as follows:



7. ASSEMBLING THE SYSTEM COMPONENTS

a. Replace the cover on the computer by sliding the cover's front lip behind and slightly below the keyboard. Align the cover with the rest of the box and push down on the rear edge until the two corner fasteners snap together.

b. Arrange the system hardware components for convenient use. One popular arrangement is as follows: Place the monitor on top of the computer. Place the disk drives on one side of the computer. If you are using a digitizer, place it on the left or right side of the computer, depending on whether you are left or right handed. Place the plotter opposite the side that that you placed the digitizer to balance the area covered.

c. Connect the monitor to the computer using the coaxial cable. One end of the cable connects to the rear side of the monitor in the video input jack. The other end connects to the video output jack on the rear of the computer. As you view the APPLE II from the rear, the connector port is to the left. If you are using a second monitor, connect one end of the coaxial cable to the video input jack on the rear side of the monitor. Connect the other end with the short connector cable from the Videx 80 column card in slot 3.

d. If you are using a HIPAD digitizer, connect the flat cable from the T & W Digitizer Interface card to the connector on the rear of the digitizer.

e. Connect the PLOTTER end of the plotter cable with the external connector on the plotter. Connect the other end with the short connector cable from the asynchronous serial interface card.

f. Connect each of the computer components (computer, digitizer, plotter, monitor) to a 120 volt grounded AC outlet using the supplied power cables. You can use a multi-socket power outlet strip which may be obtained from any electrical store.

g. Please read the next section on diskette handling before you power up the computer and proceed with the installation.

8. DISKETTE HANDLING

8.1 DISKETTE CARE

A diskette, or floppy disk, is a piece of mylar with a magnetic coating that stores data in machine-readable form. The 2D Drafting system uses a single density, soft-sectored 5 1/4 inch diskette. We suggest the following media be used:

VERBATIM -- MD 525-01-18158 (Datalife)

Floppy diskettes can be damaged by improper handling so you should observe the following practices:

a. Protect diskettes from dust, liquids, food, and other foreign particles by keeping them inside their protective jackets when not in use.

b. Never touch the exposed magnetic surfaces of the diskette. Fingerprints are oily and leave a film on the diskette.

c. Use only a soft felt tip marker to write on the disk label. Hard marking instruments will damage the magnetic coating.

d. Never use an eraser on the diskette label. The shavings will contaminate the diskette and the disk drive.

e. Don't expose the diskette to magnetic fields of any kind. Be careful of magnetic screwdrivers and paper clips.

f. Store diskettes so that they are not folded, bent, crushed under heavy objects, or exposed to high or low temperatures.

8.2 LOADING A DISKETTE INTO THE DRIVE

The following describes the correct way to load a diskette into a disk drive.

a. Remove the diskette from its outer jacket (never remove the plastic protective jacket). Hold the diskette near the label with the label upward and the oval slot away from you.

b. Lift the door of the disk drive -- it should tilt open.

c. Slide the diskette all the way into the drive. You will hear a faint click when it is in place. Close the door.

The following describes the correct way to remove the diskette from the drive:

a. Open the drive door, reach inside and pull out the diskette

b. Return the diskette to its jacket. Close the drive door.

9. BOOT UP PROCEDURE

The APPLE Pascal Operating System refers to all input and output devices as follows:

1. The monitor is called 'CONSOLE:' or volume '#1:'.
2. The parallel printer port is called 'PRINTER:' or volume '#6:'.
3. The serial input port is called 'REMIN:' or volume '#7:'.
4. The serial output port is called 'REMOUT:' or volume '#8:'.
5. On a system with only two floppy disk drives, disk drive #1 is called volume '#4:' and disk drive #2 is called volume '#5:'. This convention will be maintained in the following procedures.

This boot up procedure should be followed each time you turn on the computer.

a. Insert the 'BOOT' diskette into volume #4.

b. Turn on the power to the computer (the power switch is on the right hand side as you view the APPLE computer from the rear). Turn on the power to the monitor.

c. After a few seconds, the following message will appear on the screen:

```
COMMAND: E(dit, R(un, F(iler, C(omp, L(in


Welcome BOOT, to Apple Pascal 1.1
Based on.UCSD Pascal 11.1
Current date is 15-Jan-84


(C) Apple Computers, Inc 1979, 1980
(C) U.C. Regents 1979
```

The top line of the screen is called the Pascal COMMAND menu. If you have a 40 column screen, you can see the right side of the menu by holding down the [CTRL] key while you press the 'A' key. If all appears to be correct, continue with this installation procedure. Otherwise, refer to the Problems and Solutions section of the Application Notes.

10. COPYING DISKETTES

Your 2D Drafting system package includes diskettes containing the APPLE Pascal Operating System and all the files that are needed to run the drafting program. These diskettes are shipped with write-protect tabs to prevent accidental erasure. Do not remove these write-protect tabs.

YOU MUST MAKE A COPY OF YOUR MASTER DISKETTES THAT YOU RECIEVED.

NEVER use the original Master diskettes for routine work -- save the Masters as backup in case you damage the copy. Proceed with the instructions in this section to make copies of your Master diskettes.

10.1 EXAMINING MASTER DISKETTES FOR DAMAGE

Before you copy the Master diskettes, follow these instructions to examine them for damage.

Check them for physical damage including scratches, folds, etc. Report any damaged diskettes to your place of purchase.

Check the diskettes for bad recording media. Insert the Master 'BOOT' diskette into volume #4 and boot the computer.

At the Pascal Command menu:

You type:	The computer responds:
F (Filer)	Filer: G(et, ...
B (Bad block scan)	Bad Block scan of ?
#4: [return]	Scan for 280 blocks (Y/N)?
Y	The computer will scan the diskette looking for any bad magnetic spots on the diskette. If none were found, it will show:
	0 Bad Blocks

Repeat this procedure for all four Master diskettes by putting the next disk into volume #4 and pressing 'B', repeating from the Bad Block scan command as described above. If there were no bad blocks, you can proceed with copying your diskettes. If a Master diskette appears to be defective, contact your place of purchase for assistance or a replacement.

Q (Quit)	COMMAND: E(dit, ...

10.2 FORMATTING NEW DISKETTES

Before any new diskette can be used to store data, it must be formatted. Follow the procedure below for formatting new diskettes.

Insert the Master 'BOOT' diskette into volume #4 and boot the computer. Insert a new diskette into volume #5.

At the Pascal COMMAND menu, execute the Format program as follows:

You type:	The computer responds:
X (eXecute)	Execute what file ?
FORMAT [return]	Apple disk formatter .... Format which disk (4,5,9..12)?
5 [return]	The computer will format the disk. If the computer asks if you want to 'Destroy xxxxxx:?', the disk has already been formatted and may contain data. If you still want to format it, type 'Y'.
	Format which disk (4,5 ....
Insert another new diskette into volume #5 and repeat the FORMAT procedure.	
5 [return]	Format which disk (4,5 ...

Continue until you have formatted at least 5 new diskettes. You need at least 4 to make your back up copies of your Master diskettes and you should always have several formatted diskettes on hand to save your drawings and libraries.

When you are finished, press [return]. COMMAND: E(dit, R(un ....

As new diskettes are formatted they are given the name 'BLANK' by the system. If you are formatting diskettes to use for storing drawings or libraries, you should rename the diskettes to something other than 'BLANK' to prevent the system from becoming 'confused' if it finds two volumes of the same name on line simultaneously. Use the following procedure to rename diskettes:

Put the 'BOOT' diskette in volume #4 and the new formatted diskette in volume #5. At the Pascal COMMAND menu:

You type:	The computer responds:
F (Filer)	Filer: G(et ....
C (Change)	Change what file ?
#5: [return]	Change to what?
<vol-name>: <vol-name> may be any name up to 8 characters. Examples are: DRAW1: ARCHLIB:	BLANK ---> <vol-name>:

10.3 COPYING THE MASTER DISKETTES

The following procedure describes the steps in making exact copies of your Master diskettes but it can also be used anytime you wish to duplicate an entire diskette.

Insert the Master 'BOOT' diskette into volume #4 and boot the computer. Insert a new diskette into volume #5.

At the Pascal COMMAND menu:

You type:	The computer responds:
F (Filer)	Filer: G(et ....
(At this point be sure that the diskette to copy FROM is in #4; put the destination diskette in volume #5.)	
T (Transfer)	Transfer ?
#4: [return] (Everything on vol #4)	To where ?
#5: [return]	Transfer 280 blocks (Y/N)?
Y	Destroy BLANK:?
Y	The computer makes an exact copy of everything on the disk in volume #4 to the disk in #5. <Diskette's name:> --> BLANK:
L (List) (To verify that all files are present)	Dir listing of ?
#5: [return]	All the files on the disk in volume #5 are displayed.

Remove the Master diskette from volume #4 and place it in its jacket. Prepare a label for the new copy. It should duplicate the label of the Master diskette. Remove the new copy from volume #5 and place the label on the upper right hand corner. Do not put a write-protect tab on the copy.

Now repeat this procedure above from the T(ransfer command, putting the next Master diskette into volume #4, a newly formatted disk in volume #5, and transferring the files from volume #4: to volume #5: as described above.

When you have copied all of the Master diskettes, put the Masters away in a safe storage place (do not use the Master diskettes for routine work).

11. RUNNING THE 2D DRAFTING PROGRAM

Before running the Drafting program, you should read the ENVIRO User's Manual. The ENVIRO program is used to tell the 2D program what size workfile you have, what kind of speed-up card you have, where the files and programs are located, and other information.

To simplify startup, ENVIRO has been preset to the most common configuration for a standard two volume system. If your system configuration matches this standard environment, you may run the 2D Drafting system without making any changes to ENVIRO. If your system varies from this configuration, the ENVIRO Manual explains how to change the ENVIRO configuration to fit your system.

If you are setting up the 2D Drafting system for the first time, we suggest that you run the system for at least a few days as supplied on the floppy disks even if you will eventually load it onto a hard disk. This will allow you to verify that all components of your system are operational before proceeding.

We strongly recommend that you make only the minimum changes in the ENVIRO program necessary to run your system in the beginning. These changes include slot assignment for the serial interface card, designation of a two-screen system, type of plotter, and booster card designation. The program has grown quite large and there are only a limited number of possible arrangements of the programs and files that will run on a two drive system. The maximum number of objects that you are allowed on a two drive system is approximately 1100.

```
Workfile size in objects          1128

Input    Digitizer
Output configuration:
   interface:  CCS 7710-01        slot # 2
   plotter:    HI DMP-40
   right limit 15.0000 inches
   top limit   9.2500 inches

Booster:              No
two Monitors:         No
two Drives:           Yes

File volumes:
  2D30.CODE:          #5
  2D30.WRK.DATA:      #4
  MENU30.DATA:        #4
  MESS30.DATA:        #4
  HELP30.DATA:        #5
  PSTROKES30.DATA:    #5
  SSTROKES30.DATA:    #5
  HATCH30.DATA:       #4
  LIB30.DATA:         #4
  DRAWING FILES:      #5
  LIBRARY FILES:      #5
```

Once your system environment has been defined using the ENVIRO program, you are ready ro run the 2D drafting program. Place the copy of the Version 3.0 'BOOT' diskette into volume #4 and the 'CODE' diskette into volume #5. Turn on the computer.

At the Pascal COMMAND menu:

You type:	The computer responds:
X (eXecute)	Execute what file ?
#5:2D30 [return]	Place the 'WORK' disk into Volume #4
Insert the 'WORK' disk in volume #4 then press [return].	(Drafting system copyright message is displayed.) Press [RETURN] to continue.
[return]	Recover the workfile (Y/N) ?
N	Drafting system MAIN MENU displayed.

If you have a problem in any of these steps, please refer to the Problems and Solutions section of the Application Notes. If you are using the drafting system for the first time, you might find it helpful to work through the Tutorial in the Application Notes. Refer now to the Designer's Reference Manual for all questions regarding system functions and capabilities.

CADAPPLE

2D DRAFTING SYSTEM

DESIGNER'S REFERENCE MANUAL

RELEASE 3.0

JANUARY 1984

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PREFACE

This manual describes the operation of the CADAPPLE 2D Drafting System which operates under the APPLE Pascal Operating System V1.1. The system uses an APPLE II microcomputer (or APPLE compatible microcomputer), monitor, joystick or Houston Instruments HIPAD digitizer (11" x 11"), Hewlett Packard HP-GL plotters and Houston Instrument's DM/PL plotters. The hardware and software has been integrated by T & W SYSTEMS and is available from sales agents or from T & W SYSTEMS directly.

For information about the operating system software and the hardware see the following publications:

APPLE II:
- Reference manual #A2L0001A (030-0004-C)
- Apple Pascal
  - Operating System Reference manual #A2L0028 (030-0100-00)
- Apple Pascal
  - Language Reference manual #A2L0027 (030-0101-00)
- Apple Language System
  - Installation and Operation manual #A2L0024 (030-0059-C)

HOUSTON INSTRUMENTS:
- HIPAD user manual
- DM/PL plotter user manual

HEWLETT PACKARD:
- HP-GL plotter user manual

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SECTION 1.0 GENERAL INFORMATION

1.1 SYSTEM INTRODUCTION

The CADAPPLE 2D Drafting System creates a symbolic drawing using a digitizer or joystick for input, a graphics screen for review and editing of the drawing, and an X-Y plotter for placing the drawing on bond, vellum or mylar. The system uses a low cost, medium resolution raster-scan graphics CRT, which is used to create and manipulate a rough sketch of the final drawing. The drawing can then be drawn on a high quality, high resolution output device, such as a plotter or printer.

The system can be used to build up groups (or files) of complex symbols from primitive objects and text. These groups can then be used to make a complete drawing.

Innovative techniques are used throughout the system to provide responsiveness, ease of use, and maintain a high quality of output. Some examples are as follows. 'Groups' which are collections of primitive objects and text, are used to create and manipulate complex symbols.

A 'Help' feature provides a quick tutorial on the functions of the system. 'Windows' are used to allow any section of a drawing to be viewed at any level of detail. 'Plot specs' are used to define exactly what part of a drawing will be placed where on the plotter, and to what scale. 'Levels' can be used to create screen overlays and speed up system response time.

Throughout this manual, the phrases 'the system', 'the program' or '2D' all refer to the two-dimensional drafting program.

1.2 BASIC COMPUTER CONCEPTS

A computer receives information, i.e. input from a keyboard or digitizer. It processes that information, and displays the result, i.e. output on the screen or plotter. For the 2D drafting system, the computer uses data (the input) provided by the designer to produce (by processing the data) a drawing (the output).

1.3 THE 2D SYSTEM HARDWARE

The CADAPPLE drafting system consists of the following five basic hardware components:

1. The central processor (the 'brains') and keyboard.
2. The floppy disk drives (mass storage area).
3. The display monitor (the 'crt' or 'screen').
4. The digitizer or joystick (input device).
5. The plotter (output device).

The display monitor is used to display both text and graphics. The keyboard and digitizer are used for entering information into the computer. After input, the information is stored on a removable recording media called a 'floppy' disk (or diskette). A floppy disk is a thin piece of mylar encased in a protective paper jacket with a surface that can be magnetized to store data. The plotter is used to provide a hardcopy of the drawing entered into the computer.

The minimum hardware configuration necessary to run the 2D program includes the following: computer with 64K bytes of memory, keyboard, monitor, two standard 5 1/4" floppy disk drives (single side, double density), joystick and plotter.

Many other hardware configurations are possible. If you have questions regarding any other hardware, read the Installation manual for this program as well as the Installation manual for the hardware in question. T & W SYSTEMS will gladly advise you as to the compatibility of any special hardware components. Generally, if the hardware component's Installation manual states that it will function under Pascal V1.1, there should be no problem with it operating with the 2D program.

1.4 GETTING STARTED

1.4.1 SETTING UP YOUR DISKS

You were provided with four 2D master disks: the 'BOOT', 'CODE', 'WORK' and 'HELP' disks. When you use the 2D program, you must use a COPY of these 2D master disks. The master disks have been write-protected for a reason: to prevent you from destroying the original.

To make a copy of the 2D master disks, obtain four good quality blank disks. Copy the master disks to the blank disks using the instructions in the 2D Installation manual. Your new disks will then contain all of the programs and files necessary to create, store and plot your 2D drawings.

As the 2D program is used, the number of graphics files created and saved on disks will grow. It can be a simple task to locate drawings, if you appropriately name your graphics files. In the future a quick scan of the graphics file names can lead you to a previously created drawing, which can aid in the creation of a new drawing. A well organized filing scheme leads to very rapid and efficient creation of drawings, and is in fact the basis for the main productivity gains provided by any 2D drafting system.

1.4.2 READY TO WORK

Before you are ready to work on your 2D drafting system, be sure to read the entire Installation manual. There are several important steps concerning your hardware set up that must be followed.

Once again, do not use the original disks that you received. Locate the copies of the master disks that you were instructed to make and follow this startup procedure for a two drive system:

1. As you look at the rear of the computer, turn the machine on by pushing the power switch (located in the lower right hand corner) to the 'ON' position.

2. Lift the door on both drive #1 and #2. Hold the labeled edge of the 'BOOT' disk, with the label facing up, and push the disk into drive #1. The disk will 'click' into place. Hold the labeled edge of the 'CODE' disk, with the label facing up, and push the disk into drive #2. The disk will 'click' into place.

3. The two floppy disk drives are normally labeled drive #1 and drive #2. This manual and the 2D program refers to drive #1 as volume #4 and refers to drive #2 as volume #5. This is done to conform with the Pascal operating system.

4. Close the door on both of the disk drives. The machine will make some noise, and in a few seconds the screen will light up and display a menu.

5. At this point you are at the 'Pascal operating system level'. This is the base level of the machine. All work starts here. Notice the top line of this screen. This line is called the Pascal operating system main menu. A menu is a list of all possible options that you have at a particular point. The two most important options on this menu are the ones labeled X(ecute and F(iler. The X(ECUTE option allows you to run (or execute) any program on your disk. The F(ILER option allows you to manipulate the files on your disk.

6. Press the 'X' key to choose the X(ECUTE option off the Pascal operating system main menu. A prompt will appear that will ask:

   Execute what file ?

7. Since the 2D program is stored on the 'CODE' disk in volume #5, you must respond by typing in the name '#5:2D30' followed by the [RETURN] key. The program will shortly display the following message:

   Place the 'WORK' disk into volume #4.
   Press [RETURN] to continue.

8. Lift the door on volume #4. Since there is not enough room to store program information on only two disks, you must remove the 'BOOT' disk from volume #4 and replace it with the 'WORK' disk. Once you have swapped the disks, close the door on volume #4 and press the [RETURN] key. The computer will shortly display the following copyright screen:

C A D A P P L E

Two-dimensional Drafting
Version 3.0
Copyright @ 1981
by T & W SYSTEMS, INC.
all rights reserved
serial number: xxxx
plotter: xxxxx

T & W SYSTEMS, INC.
7372 Prince Drive, #106
Huntington Beach, CA 92647
(714) 847-9960

Disk duplication permitted for
archival purposes only.

Press [RETURN] to continue

9. The 2D program is now in control of the computer. The copyright notice, software version number, serial number and plotter type are now displayed. If you encounter any problems with the 2D program, call T & W SYSTEMS describing the situation. Be ready to report the software version number and the serial number displayed. Press the [RETURN] key to continue. The program may display the following message:

'Recover the workfile (Y/N)?'

10. The program is asking if there is any valid information in the workfile that you want to recover. This situation might occur if the computer went 'down' (power failure, power off) or the 'RESET' key on the computer was accidentally pressed. If you press the 'Y' key, the program will attempt to recover as much information as possible from the workfile. If you do not care about what is in the workfile, press the 'N' key. Generally, you would press the 'N' key because you would have saved your drawing before you quit working with the 2D program.

11. The program will now display the 2D MAIN MENU. It is from this menu that all 2D drafting functions can be reached.

Here are a few special notes for those using two standard floppy disk drives:

a. You must follow each of the steps described in the procedure above in order to run the 2D program.

b. Do not attempt to reorganize the files on the disks. Your disks have been configured to rum on a computer with two standard floppy drives. There are not many other configurations that will work with this type of hardware.

c. Once you have swapped the 'BOOT' and 'WORK' disks as described in the procedure above, note that the 'WORK' disk must ALWAYS be in volume #4 at all times. If this disk is removed while the 2D program is in operation, the 2D program will not function properly.

d. On the other hand, there are times that the 'CODE' disk can be removed from volume #5. Instructions on performing this operation will be provided in later sections such as the LIBRARY and FILER.

SECTION 2.0 2D CONCEPTS

2.1 THE 2D PHILOSOPHY

The 2D general purpose drafting program is a powerful drafting tool that is extremely easy to use.

From the beginning, the program was designed with this two fold goal in mind - to help the novice user quickly get up the learning curve and yet provide the experienced user with the needed capabilities.

The program provides the following features to insure ease of use:

1. The program is 'menu driven'. The use of menus has proven to be one of the best ways of communicating with the user.

2. The program always tells you what your options are. If an option is displayed on the screen then you can use it, if it is not, you can't.

3. The program uses the 'what you see is what you get' philosophy. You can see on the screen exactly what the final plot will look like before it is plotted.

4. The program is interactive. That is, you are given immediate visual and audio feedback on all of your actions. For example, you can actually see portions of your drawing being dragged across the screen, all under your direction.

5. The program has predefined 'default' actions and values that enable the novice user with a minimal understanding of the operation of the program, to produce usable drawings. But these 'defaults' can be changed at will by the experienced user, providing him with much more power.

6. The program never allows the user to 'trap' himself. If the user finds that he has taken an unknown path, he need only type the [ESC] key to abort his erroneous action.

Many of the advanced features are described in the sections that follow.

2.8 WINDOWS

The 2D program allows the user to view the drawing through any user defined viewing 'window'. To understand what a window is, imagine that the screen is a movable window through which you view your drawing. The program allows you to move your viewing window and thus look at different portions of your drawing. In addition, you can shrink the window so that you are looking at only a tiny detail of the drawing or you can expand the window and look at a large, overall view of the drawing.

2.9 PROPERTIES

As primitive objects are created, they are given several attributes or properties that determine, in part, what they will look like. An example of a property is the type of linestyle (dashed or dotted) that will be used to plot the object. These default property values can be changed by the user at any time, giving him complete control over the appearance of the final drawing.

2.10 REAL WORLD COORDINATES

All numeric input to the 2D program is in terms of real world X,Y coordinates. For example, objects are placed using real world coordinates. Grids and windows are defined using real world coordinates.

What are 'real world coordinates'? They reflect the actual size of the object you are drawing. For example, if an architect was designing a room addition for a house, then all of the information about the room would be entered at actual scale, i.e.; if the width of the room is 20 feet, then the lines making up the walls of the room would be entered as 20 feet. This process makes it easier on the operator, since he does not have to worry about any scaling operations. All scaling is done when a plotted hardcopy is needed.

2.11 STATUS LINE

The program has a special use for the bottom line of the text screen. This line is called the status line. The program uses the status line to display several important pieces of information. Typically, the status will look like the following:

```
MAIN MENU  [100.5000,     50.2500]  IDT.
```

The first field displays the current menu title. In the above example, 'MAIN MENU' is the current menu. If the ADD option is selected, then the title 'ADD' will be displayed.

The second field displays the current real world X,Y position of the graphics input device, such as the digitizer or joystick, on the coordinate dial. When the position of the digitizer or joystick is changed, the program will immediately update the dial with the new X,Y position.

The third field displays the state of the snap mode. 'I' indicates that increment snap is on. 'G' indicates that grid snap is on. '.' indicates that neither increment snap nor grid snap is on.

The fourth field displays the state of the coordinate input mode. All X,Y coordinate data must be entered in the appropriate manner. 'D' requires digitizer input. 'J' requires joystick input. 'A' requires absolute keyboard input. 'R' requires relative keyboard input. 'P' requires polar keyboard input.

The fifth field displays the state of the object tracking mode. If 'T' is displayed, then the object tracking mode is on and objects will interactively follow the cursor. if '.' is displayed, then object tracking is off.

The sixth field displays the state of the drawing's origin. If 'O' is displayed, then the origin of the drawing has been shifted. If '.' is displayed, then the origin has not been shifted.

2.12 FUNCTION KEYS

The program uses several function keys to activate special system features. A unique thing about a function key is that it can be used any time the cursor is being used. For example, it is possible to turn the increment snap option on or off while performing a very complex operation. Each function key is selected by simultaneously pressing the [SHIFT] key and the appropriate character key as described below.

Most of the function keys have immediate visual feedback telling you that the function was successfully pressed. For example, when you press the function key '*', the cursor will change its size. Other function keys display a character near the coordinate dial in the lower right hand corner of the text screen. These characters are used to indicate the status of the particular function. For example, when you press the function key '%', the program will change the snap state and update the snap character in the lower right hand corner of the text screen.

The functions performed by these special keys are described below:

- Coordinate dial: '!' switches the coordinate dial on or off. When the coordinate dial is turned off, the graphics processing speed is increased.

- Scaling reset: '#' resets the digitizer or joystick scaling and allows the cursor to track the digitizer's or joystick's movement across the entire graphics screen.

- Digitizer or joystick scaling: '$' is the digitizer or joystick scaler. When used, the movement of the digitizer or joystick is restricted to 1/4 of the graphics screen presently accessible. This function may be repeatedly used until you have successfully placed the cursor on the desired screen dot.

- Snap mode: '%' switches between the three different snap modes. The mode that is presently being used is indicated in the lower right hand corner of the text screen. 'I' indicates increment snap is enabled. 'G' indicates grid snap is enabled. '.' indicates that neither increment snap nor grid snap are enabled.

- Tracking mode: '&' switches the tracking mode on or off. The mode that is presently being used is indicated in the lower right hand corner of the text screen. 'T' indicates that the tracking mode is on. '.' indicates that the mode is off.

- Long and short cursor: '*' switches between a short cursor and a long cursor. The long cursor spans the entire graphics screen.

- Display modes: '(' switches between the three display modes of the screen. The first mode is a complete screen of text. The second mode is a complete screen of graphics. The third mode is a screen consisting of 5/6 graphics and 1/6 text.

- Coordinate input modes: ')' switches between the different coordinate input modes. The mode that is presently being used is indicated in the lower right hand corner of the text screen. 'D' indicates digitizer mode. 'J' indicates joystick mode. 'A' indicates absolute mode. 'R' indicates relative mode. 'P' indicates polar mode.

It is advisable that a strip of paper abbreviating these functions be placed above the function keys. This will make it easier to remember which key activates a particular function.

2.13 THE COORDINATE DIAL

The 2D program provides the designer with a continuous readout of the cursor's real world location. This readout, called the 'coordinate dial', is located in the lower right hand portion of the text screen. The X,Y coordinates displayed are always in terms of real world coordinates. The program will try to display the seven most significant digits on the coordinate dial. No more than four decimal digits of precision will be displayed. For example, numbers like 100.5000, 0.1250 and 12500.25 will typically be displayed. Numbers like 12500.2500 and 25375.1250 will not be displayed. Function key '!' is used to turn the coordinate dial on or off for increased graphics processing speed.

2.14 INPUT MODES

The 2D program provides the designer with five ways of specifying X,Y coordinates while creating or manipulating a drawing. The designer has total freedom over which of the five input modes to use. He can switch from one mode to another at any time.

The first two input modes available are called 'free' modes. These modes use the digitizer or joystick. Moving the digitizer or joystick moves the screen cursor. The designer's arm movements are thus translated into cursor movements on the screen. As the digitizer cursor or joystick handle is moved, objects can be made to follow the cursor on the screen. This feature makes the free modes a very 'visual' form of input because you can always see, and immediately change, the relationships between the various pieces of the drawing. The free modes make use of the snap feature to insure precise placement of the cursor on the drawing surface.

The other three input modes are collectively called the coordinate input mode. These three modes allow you to type in the actual coordinates using the keyboard. The coordinates are defined in three ways - absolute, relative and polar. The coordinate input mode does not use the snap feature. If snap mode is turned on, then the coordinate input mode just ignores it. In other words, what the designer types in is what the designer gets.

The absolute input mode is simplest. In this mode, the program will ask you to type in the absolute real world X and Y coordinates. Simply type in the appropriate numbers followed by a [RETURN]. The program will use these coordinates to do its calculations.

The relative input mode is a little more complicated. In this mode, the program will ask you to type in relative coordinates. These coordinates are relative to a reference point on the drawing.

The reference point is always set to the last (X,Y) coordinate defined. There is one exception. If you have just entered the MODIFY option, the reference point is initialized to the blinking object's 'handle point'. For example, a line's handle point is its first endpoint and a circle's handle point is its center. Thereafter, the reference point is set to the last (X,Y) coordinate defined.

The third coordinate input mode is the polar mode. This mode allows you to use a polar coordinate system. In this mode, the program will ask you to enter the angle and distance to the polar point. The angle is in degrees and is measured counterclockwise from the horizontal. The distance is in real world units. The information entered through the polar mode is relative to the same reference point as described in the relative mode.

For example, it is possible to define one endpoint of a line using the digitizer, switch to the relative mode and define the second endpoint of the line in relative coordinates. This flexibility can be very useful at times.

The 2D program starts in the digitizer (free) input mode. But, the input mode can be changed any time by using function key ')'. If you are using a 40 column display, then in order to see the prompts that allow absolute, relative and polar coordinate input, you must type a [CTRL-A]. This will place you on the screen's alternate 40 column display. To display the menus and the original 40 column display, simply type a [CTRL-A] once more.

If the drawing's origin has been shifted, then any coordinates entered using the digitizer, joystick, absolute, relative or polar input modes will automatically be shifted to be relative to the new origin.

2.15 JOYSTICK OPERATION

The 2D program supports the use of a joystick as the graphics input device. The joystick is a very economical input device, but its accuracy and operation does not match that of the digitizer. Because of the joystick's inherent lack of resolution, two function keys are used to remedy this deficiency. Function key '$' will scale the joystick's movements down by 1/4. This means that the full swing of the joystick's handle is mapped into a smaller screen area, thus providing an increase in resolution and accuracy. Function key '#' will reset the joystick's movement to the full screen area.

2.16 SNAP

It is sometimes difficult to precisely position an object using the cursor. This is due to the visual problem of placing the cursor exactly on a desired X,Y location. Even if you do move the cursor so that it appears to be at the desired location, the limitations of the screen resolution almost guarantee that you are not exactly where you want to be. It would seem that the only way to get the exact location is to type it in using the coordinate input mode. In order to solve this problem, the 'snap' feature was implemented. Snap will round the cursor and coordinate dial to a precise X,Y location. The state of the snap function is displayed near the coordinate dial in the lower right hand corner of the text screen. The program provides function key '%' to cycle through the following snap modes.

Increment snap:

When increment snap is on, the program will round the position of the cursor and coordinate dial to the nearest user defined increment. Thus, allowing you to obtain a precise X,Y position on the screen. For example, if the user defined increment is 0.125 inches, then each point entered with the digitizer or joystick will be automatically rounded to a multiple of 0.125 inches. Increment snap is on if the 'I' character is displayed near the coordinate dial.

Grid snap:

When grid snap is on, the program will round the position of the cursor and coordinate dial to the nearest grid intersection. Thus, allowing you to obtain a precise X,Y position on the screen. For example, if the grid spacing was set to 1 inch, then each point entered with the digitizer or joystick will be automatically rounded to a multiple of 1 inch. Grid snap is on if the 'G' character is displayed near the coordinate dial.

No snap:

The third snap mode disables both increment and grid snap. The cursor and coordinate dial will use the best resolution possible. Snap is disabled if the '.' is displayed near the coordinate dial.

If any of the coordinate input modes are being used, such as absolute, relative or polar, then the state of the snap function will not affect the values entered from the keyboard. That is, if increment snap is on and absolute mode is being used, then the absolute X,Y coordinate typed in from the keyboard will not be rounded to the nearest user defined increment.

2.17 OBJECT TRACKING

Normally all drawing manipulation is done interactively, that is, objects change size and orientation on the screen as you move the cursor. This provides a very effective visual feedback and in general seems to be easier to use. We call this interactive mode of operation object tracking, since all graphics objects track or follow the movements of the cursor. However, tracking does have its disadvantages. For example, the tracking of an object can slow down the response of the program. So, by using the track function key '&', the program allows you to turn off the tracking mode throughout the entire program whenever you need the increased speed. Object tracking is on if 'T' is displayed near the coordinate dial in the lower right hand corner of the text screen. Object tracking is off if '.' is displayed.

2.18 LONG CURSOR

The normal short cursor that appears on the screen looks like a small crosshair. The 2D program also provides an alternate long cursor. The long cursor is a large crosshair that extends across the entire screen. In addition to being entirely equivalent in function to the short cursor, it provides a means for exact visual alignment of objects. Function key '*' allows you to switch between the long cursor and the short cursor.

2.19 DISPLAY SCREENS

The 2D program uses three different screen display modes. The first screen displays nothing but text. All of the program menus and messages are displayed on this screen. The second screen displays nothing but graphics. All of your drawing is displayed on this screen. The third screen displays both text and graphics, i.e., the upper 5/6 of the screen is dedicated to graphics and the lower 1/6 of the screen is dedicated to text. This third screen is very useful since you can view your drawing, coordinate dial, menu title and various program messages simultaneously. Function key '(' cycles through the display screens.

However, if you are using two screens, that is, one screen to display the program's menus and the other screen to display the drawing, then the 2D program uses two different display modes. The first screen displays nothing but graphics and the second screen displays both text and graphics. Once again, the function key "(" cycles through the display screens.

2.20 CLEARING THE MESSAGE LINES

Three of the bottom four lines of the text screen are called the message lines. The program uses these lines to display messages, prompts and other information. Hitting the [RETURN] key while at a menu will erase any text that happens to be displayed on these message lines.

2.21 INPUT FROM THE KEYBOARD

Much of the information that the 2D program needs is supplied by input from the digitizer. However, it is sometimes necessary to type information in at the keyboard. The types of information that you must enter fall into three classes, text characters, numbers (both real and integer) and answers to short questions. For example, you may have to type in the names of groups, the floating point values of grid spacing or answer 'Y' or 'N' to a question.

Text characters are entered by typing the appropriate characters on the keyboard. The [LEFT ARROW] key (throughout the rest of this manual, this key will be referred to as the [BS] key) is used for correcting single character mistakes. Each time the [BS] key is typed, the last character will be erased. The [ESC] key is used to abort the operation that required the entry of text characters. In general, you should type the [ESC] key if you have accidently chosen an option and want to leave without doing anything. The [RETURN] key is used to terminate the entry of a string of text characters. Hitting the [RETURN] key tells the program that the characters you just typed are 'ok' and that it should read and process them. Refer to the Appendix of this manual for a complete character set listing. All of the characters that the 2D program can accept from the keyboard are listed.

There are two types of numeric data that may be entered from the keyboard, integer numbers and real numbers. Both types of numbers are entered by typing the appropriate digits on the keyboard. Any 'illegal' keys that might be typed are simply ignored. The [BS] key is used for correcting single digit mistakes. Each time the [BS] key is typed, the last digit will be erased. The [ESC] key is used to abort the operation that required the entry of numeric data. In general, you should type the [ESC] key if you have accidently chosen an option and want to leave without doing anything. The [RETURN] key is used to terminate the entry of a number. Hitting the [RETURN] key tells the program that the number you just typed is 'ok' and that it should read and process it.

The range of integer or real numbers that can be typed in at the keyboard is -32767 to 32767. The program will not accept any numbers outside of this range. If a number outside of this acceptable range is typed in, the program will 'beep' at you, erase the number just entered, and reposition you to enter the number again.

The 2D program asks several questions that require a single, one character answer. These include 'Yes' or 'No' type questions or selecting options from the menus. All of these questions can be answered by typing the appropriate character. In general, any question that can be answered by typing a single key does not need to be terminated with a [RETURN].

2.22 LOSS OF PRECISION

All computers have a limit on the number of decimal digits of precision that they can deal with. The more digits that must be precisely dealt with, the more space and time it takes the computer to deal with them.

The 2D program can store and manipulate real numbers that have at most 7 decimal digits of precision. So, for example, a number such as 132.0625 can be represented precisely to its full 7 digits. However, a number such as 2132.0625 cannot be represented to its full 8 digits of precision and would have to be approximated. In order to maintain the highest possible precision, the 2D program will not allow you to type in real numbers that cannot be represented exactly.

However, controlling the numbers that can be typed in only solves the easy part of the loss of precision problem. The more difficult part of the problem deals with internal calculations. The fact that real numbers can be represented to at most 7 digits also means that the maximum number of decimal digits that can be maintained throughout a calculation is 7. Thus, while both 2000.0 and 132.0625 can be represented exactly, their sum 2132.0625, cannot. It would be very difficult, if not impossible, for the program to determine at the time of input, which legal real numbers might later lead to a loss of precision in a calculation.

The user must be aware that this loss of precision is possible and he should guard against it. It will only happen if you expect the program to precisely maintain numbers that vary greatly in order of magnitude. For example, a drawing of a 2000 feet by 1000 feet building cannot be maintained to a precision of 1/16th of an inch.

Some of the visual signs of a loss of precision are lines that no longer line up, objects that don't follow the cursor exactly, and in extreme cases objects that have become distorted.

2.23 HANDLE POINTS

Several of the options allow you to manipulate objects on your drawing by their 'handle' point. The handle point is the point by which the cursor will 'hold on' to an object or group while it is being manipulated. For example, when moving a group you pull it across the screen by its handle point.

All objects are given a default handle point when they are created. Several objects are also given a 'secondary' handle point. The handle points are defined in the following table:

Object	Initial handle point	Secondary handle point
LINE	First endpoint defined	Second endpoint defined
RECTANGLE	First corner defined	Second corner defined
POLYGON	Center	None
CIRCLE	Center	None
ELLIPSE	Center	None
ARC	Center	None
POINT	Center	None
BEZIER	First endpoint defined	Second endpoint defined
TEXT	Lower lefthand corner	Upper righthand corner

2.24 THE HELP OPTION

The HELP option provides the designer with helpful information about the 2D drafting system as he is working on a drawing. It is like a handy reference card that briefly explains each available menu choice. The HELP option is selected from any menu that displays the [?] option. Simply type the '?' character.

Before any HELP information can be displayed, the 'HELP' disk must be in drive #5. The program expects the 'HELP' disk to be in drive #5 so that the HELP information may be read from the disk in that drive and displayed on the screen. Remove the 'CODE' disk from drive #5 and replace it with the 'HELP' disk. Do NOT remove the 'WORK' disk from drive #4.

Once the 'HELP' disk has been placed in drive #5 and the HELP option has been selected by typing the '?' key, the program will respond with:

> HELP: pick the item on the menu you want
> to learn about. Hit [ESC] to abort.

If you accidently entered the HELP mode, hit the [ESC] key to exit. If the above message does not appear, then you probably forgot to remove the 'CODE' disk from drive #5 and replace it with the 'HELP' disk. The following message will appear instead:

> Place 'HELP' disk in volume #5.
> Press [RETURN] to continue.

When you have swapped the disks, press the [RETURN] key and once again press the '?' key to select the HELP option.

To continue on with HELP simply select the option from the menu currently displayed along the side of the screen. The program will then display a brief, yet concise explanation of the option that you selected. The explanation may be several pages long. At the end of each page the program will tell you:

> [RETURN] continues, [ESC] exits help.

Pressing any key (other than the [ESC] key) will cause the program to display an additional page of the HELP information. If there is no more HELP information available or you hit the [ESC] key, the program will immediately leave the HELP mode and return to the appropriate menu.

Once you have received enough HELP information, remove the 'HELP' disk from drive #5 and place the 'CODE' disk in drive #5. Remember, do NOT remove the 'WORK' disk from drive #4!!

2.25 THE WORKFILE

The 2D program always keeps a copy of the drawing that you are currently working on in a 'workfile'. A workfile is just a temporary file on your diskette that is used only by the 2D program to store this copy. Working on the data within this workfile has no affect on any drawings saved in other files on your diskette.

You are never working on the 'original' copy of your drawing, unless the drawing is a new one. You are always working on the copy stored in your workfile. By always working on a copy you are assured that any drastic mistakes will only affect the copy and not the original.

Whenever you are working on a drawing, you should periodically save it on the disk. This will write the current copy of the drawing saved in the workfile to a permanent file. This practice provides you with a permanent 'backup' in case you have manipulated your workfile to the point that it has really become messed up. If you have saved your workfile occasionally, then recovering the contents of your drawing before the 'disaster' is not nearly as time consuming as having to go back and 'undo' your mistakes or starting again from scratch.

Whenever you feel that your drawing is finished, you should save the contents of the workfile as a permanent disk file. This disk file can later be retrieved, and put back into the workfile.

When you decide to quit working with the 2D program, select the EXIT option from the MAIN MENU. The machine will verify that you indeed wish to leave the program. A 'N' answer returns you to the 2D MAIN MENU. A 'Y' answer will return you to the APPLE Pascal operating system environment. A good practice is to always save your drawing on the disk before you quit using the program.

The maximum number of objects that can be added to your workfile is approximately 4000. In order to have this many objects, a mass storage device such as a hard disk will be needed. IF you are working with only two standard 5 1/4" disk drives, then the maximum number of objects that can be added to your workfile is approximately 1100. In short, the more mass storage available - the larger the drawing can be.

2.26 RECOVERY

The 2D program provides you with a very complete 'recovery' feature. This feature makes it virtually impossible for you to ever lose any of your work, even if the machine should lose power or for some other reason 'go down'. Except under unusual circumstances, the most that you will lose after a machine failure is the result of your last operation.

The program accomplishes this recovery by constantly updating a copy of your workfile that is stored on your diskette. As you make a change to your drawing, it is recorded in that copy of your workfile.

In addition to saving a copy of your drawing in the workfile, the program also saves the current values of all your defaults and switches, all windows that have been saved, all plot specs that have been defined, and your current viewing window. This means that the workfile contains all the information needed to completely restore your working environment should an unexpected interruption occur.

If the program is unexpectedly interrupted or aborted you must 'recover' the workfile in order to begin where you left off. Whenever the 2D program is run, it usually asks the following question:

Recover the workfile (Y/N)?

Pressing a 'Y' in response to that question will recover your previous workfile and restore the working environment contained in that workfile.

2.27 TEMPLATE OBJECTS

The 2D program does not support hidden line removal or the drawing of partial objects, but 2D does support the use of 'template' (or guide) objects. For example, let us say that there is a rectangle on the screen, and a circle is to be placed in such a way that it appears as if it is in front of the rectangle. Once the circle is placed, the rectangle is still completely visible. A hidden line removal feature would remove from the screen the sections of the rectangle that are behind the circle. A partial objects feature would allow you to manually modify the rectangle so that sections are removed from view. The 2D program uses 'template' objects to solve the problem.

The 2D program uses a unique approach to do hidden line removal by putting some of the responsibility on the designer. In order to give the appearance of a circle in front of a rectangle, the program allows you to create 'template' objects. A template is really nothing but a standard 2D object given the template property. When defined as a template, an object is drawn with dots. These dots are the key to making the sections of the rectangle behind the circle disappear from the screen.

The solution to this problem is simple. First, the designer should draw a template rectangle on the screen, and then draw a non-template circle in front of it. The rectangle is still fully visible on the screen, but in the form of dots. Lines are then used to trace over the dotted sections of the rectangle that are to remain on the screen. When the designer is satisfied with the drawing, he should delete the template rectangle from the drawing. The drawing will now show a circle in front of a rectangle with the hidden sections of the rectangle removed.

SECTION 3.0 USE OF COMMANDS

3.1 CADAPPLE PROGRAM MAIN MENU

3.1.1 FUNCTION SELECTION

The 2D program MAIN MENU is displayed automatically when you start working. It can be reached from any point in the program simply by entering successive 'Q' (for quit) characters. Each 'Q' entered causes you to leave the present menu, and return to the menu one level higher. The program does not 'nest' menus more than 3 deep. So, returning to the MAIN MENU from the lowest menu level takes minimal time.

The MAIN MENU looks like this:

MAIN MENU: version 3.0

[A] Add
[M] Modify
[G] Group
[F] Filer
[U] Units
[P] Properties
[S] Switches
[W] Window
[L] Library
[H] Hatch
[N] iNquire
[I] Input
[O] Output
[K] sKetch
[E] Exit
[?] Help

3.1.2 PURPOSE

The MAIN MENU has one specific purpose, and that is to provide you with a means to reach the specific 2D functions you will need to create your drawings. This menu could be thought of as the main hallway containing many doors. Each door in the hallway performs no specific task except to lead you to a room filled with options that actually perform a task.

For example, the ADD menu is a 'door' on the MAIN MENU. You cannot add any objects simply by choosing the ADD option from the MAIN MENU. Rather, you must select the ADD option from the MAIN MENU (open the door, and enter). When the ADD menu is displayed for you (options that perform a task), select the particular object you wish to create.

3.2 ADD

3.2.1 FUNCTION SELECTION

The ADD option is selected from the MAIN MENU of the program. Simply choose the 'A' character from the keyboard.

The ADD menu looks like this:

```
ADD:
 [A] Arc
 [B] Bezier curve
 [C] Circle
 [E] Ellipse
 [L] Line
 [P] Polygon
 [R] Rectangle
 [O] pOint
 [T] Text
 [D] Dimension
 [G] Group
 [U] Update properties
 [K] sKetch
 [Q] Quit
 [?] Help
```

3.2.2 PURPOSE

The ADD option allows the user to create the elementary items that compose a complex drawing. The elementary items include: lines, rectangles, circles, circular arcs, dimensions, ellipses, Bezier curves, regular polygons, points, and text.

The ADD menu lists all of the primitive graphics objects that the 2D program can create. Select the object that you wish to create from the menu, and it will be interactively drawn on the screen as directed by the movements of the cursor.

3.2.3 DATA ENTRY

The digitizer is used to place an object's characteristic points. This is done by moving the cursor to a specific location with the digitizer, and then pressing the cursor button. The object is fixed or 'accepted' when the final characteristic point associated with that object is placed.

Hitting the [ESC] key while in any ADD option immediately aborts that option and returns to the ADD menu. In addition, if at any time during the creation of an object you wish to see that object blink, then simply select the object tracking function. This causes the blinking to start. Selecting the tracking function key again causes the blinking to stop.

When you are creating an object, you will notice that a sub menu is displayed along the side of the screen. This sub menu tells you that you can perform special functions on the object that you have selected to create. Simply choose the letter between the '[' and ']' characters.

When an object has been added to the drawing, it will be assigned the properties displayed on the PROPERTIES menu. For example, if the current group name property is set to "DOOR", then the object will be automatically assigned this group name. Further, if the linestyle property is set to #7 (long dash for HI plotters), the object will be assigned this linestyle and drawn using this linestyle.

3.2.4 ARC

The ARC option allows you to create a circular arc. In the 2D program, arcs can be defined in two different ways.

a. Three points on the arc.
b. Center and two endpoints of the arc.

THREE POINTS ON THE ARC: The three characteristic points are:

1) One endpoint of the arc.
2) The second endpoint of the arc.
3) A third, arbitrary point on the arc.

To use this method, position the cursor and accept the two endpoints of the arc. If object tracking is on, the program will repeatedly draw an arc through the cursor. Move the cursor until you are satisfied with the shape of the arc and press the cursor button to accept it. If you know the radius of the arc, then select the Radius option to help position the third point.

Using the Radius option: after the two endpoints of the arc have been placed, type 'R' and enter the desired radius of the arc. As you move the cursor near the arc, the program will display the four possible arcs that may be drawn with those two endpoints and that radius. When you are satisfied with the arc displayed, accept it by pressing the cursor button. If the arc radius you enter is too small, the program will display an error message and give the smallest possible radius.

CENTER AND TWO ENDPOINTS: The three characteristic points are:

1) The center of the arc.
2) One endpoint of the arc.
3) The other endpoint of the arc.

To use this method, first press 'C' on the keyboard before you define the first characteristic point. Then position the cursor and press the cursor button to enter the center of the arc. Next, position the cursor and enter the first endpoint of the arc. If object tracking is on, the program will repeatedly draw an arc. Move the cursor to locate the other endpoint of the arc and press the cursor button to accept it.

The program will not draw an arc until the first two characteristic points have been accepted.

The keyboard options available while creating an arc are:

'A': Causes an arrowhead to appear on one end of the arc. Hitting the 'A' again will remove the arrowhead.
'T': Causes the arc to become a template arc. Hitting the 'T' again will turn off the template option.
'M': Causes a marker to be displayed at the center of the arc. Hitting 'M' again will remove the marker.
'F': Allows the radius of the arc to be determined by the position of the cursor. The program is in this mode when the three points Arc option is first selected. This option is only available when the arc is drawn by the three points method.
'R': Allows the radius to be specified when entering an arc by the three points method.
'D': Causes the arc to be drawn in the opposite direction. This option is meaningful only when you are using the center and two points method.
[ESC]: Aborts and erases the arc added during the current add arc operation.

3.2.5 BEZIER

The BEZIER option allows you to create one or more Bezier curves. In the 2D program a Bezier curve is defined by four characteristic points:

1) The first endpoint of the curve.
2) The second endpoint of the curve.
3) The first and second curve control points. These two points determine the shape of the curve.

The program will not draw a Bezier curve until the two endpoints have been defined. These points are defined by moving the cursor to the desired locations on the screen and then pressing the cursor button. Once these two points have been defined and object tracking is enabled, the program will repeatedly draw a Bezier curve whose shape is dependent upon the location of the two control points. Moving the cursor will now move both control points. You can move just the first or the second control point at any time buy selecting the appropriate keyboard option (see below). The program always draws from the first endpoint to the first control point, to the second control point, and then to the second endpoint. By moving the two control points separately, you can create interesting shapes. When you are satisfied with the curve, accept it by pressing the cursor button.

Bezier curves can be linked together to appear as if they form one continuous curve with many inflection points. This can be done as follows:

1. Create a Bezier curve. Be sure that the markers are on. Draw a template line through the second control point and the second endpoint of the bezier. It is best if the line extends all the way across the screen.

2. Create a second Bezier. Be sure that the beginning point of the second Bezier is the same as the ending point of the first Bezier. The second endpoint of the second Bezier can be placed wherever you would like it.

3. Position the first control point of the second Bezier in such a way that it lies on the dotted template line.

4. Position the second control point of the second Bezier wherever you would like it to be.

5. The resulting Bezier curves should appear to be continuous.

The BEZIER CURVE menu options available are:

'F': Causes the first control point to follow the cursor and fixes the second control point at its current location.
'S': Causes the second control point to follow the cursor and fixes the first control point at its current location.
'B': Causes both control points to follow the cursor. The program is in this mode when the Bezier option is first selected.
'P': Fixes the location of both of the control points and allows the cursor to be moved around freely without changing the shape of the curve.
'M': Causes a marker to be displayed at all four characteristic points of the Bezier. Hitting 'M' again will remove the markers.
'A': Causes an arrowhead to appear on the end of the Bezier. Hitting 'A' again will remove the arrowhead.
'T': Causes the Bezier to become a template Bezier. Hitting 'T' again will turn off the template option.
[ESC]: Aborts and erases the Bezier added during the current add Bezier operation.

3.2.6 CIRCLE

The CIRCLE option allows you to create a circle. In the 2D program, circles can be defined in two different ways.

a) Center and radius.
b) Diameter

CENTER AND RADIUS: The two characteristic points for creating a circle by the first method are:

1) The center of the circle.
2) The radius of the circle.

To draw a circle by this first method, move the cursor to the location on the screen where you want the center of the circle then press the cursor button. If object tracking is on, the program will repeatedly draw a circle whose radius grows larger as you move the cursor away from the center, and smaller as you move toward it. When you are satisfied with the size of the circle, accept it by pressing the cursor button.

DIAMETER: The two characteristic points for creating a circle by the second method are:

1) One endpoint of the circle's diameter.
2) The other endpoint of the circle's diameter of the circle.

To draw a circle by the second method, first press 'D' on the keyboard then locate the cursor where you want one edge of the circle and accept it by pressing the cursor button. If object tracking is on, as you move the cursor away from the first point, the program will repeatedly draw a circle whose diameter is the distance from the cursor to the first point. When you are satisfied with the size of the circle, accept it by pressing the cursor button.

The keyboard options available while creating a circle are:

'T': Causes the circle to become a template circle. Hitting 'T' again will turn off the template option.
'M': Causes a marker to be displayed at the center of the circle. Hitting the 'M' key again will remove the marker.
[ESC]: Aborts and erases the circle added during the current add circle operation.

3.2.7 ELLIPSE

The ELLIPSE option allows you to create an ellipse. In the 2D program, ellipses can be defined in two different ways:

a) Minor and major axes.
b) Center, minor and major.

MINOR AND MAJOR AXES: The three characteristic points for creating an ellipse by the first method are:

1) One endpoint of the minor axis.
2) The other endpoint of the minor axis.
3) One endpoint of the major axis.

To create an ellipse using this method, move the cursor to one endpoint of the minor axis and press the cursor button. Then move the cursor to the other endpoint of the minor axis and press the cursor button. If object tracking is on, the program will repeatedly draw an ellipse whose major axis is located at the position of the cursor. Press the cursor button when you are satisfied with the shape and rotation of the ellipse.

CENTER, MINOR AND MAJOR: The three characteristic points for creating an ellipse by the second method are:

1) The center of the ellipse.
2) One endpoint of the minor axis.
3) One endpoint of the major axis.

To create an ellipse using this method, first type 'C' on the keyboard, then place the cursor where you want the center of the ellipse to be and press the cursor button. Next, move the cursor to position one endpoint on the minor axis and press the cursor button. If object tracking is on, the program will repeatedly draw the ellipse. Move the cursor to locate the endpoint of the major axis and press the cursor button when you are satisfied with the shape and rotation of the ellipse.

The program will not draw an ellipse until the first two points have been defined.

The keyboard options available while creating an ellipse are:

'T': Causes the ellipse to become a template ellipse. Hitting the 'T' again will turn off the template.
'M': Causes a marker to be displayed at the center of the ellipse. Hitting the 'M' key again will remove the marker.
'X': Causes the ellipse to be rotated about its center of the minor axis in such a way that the major axis is parallel to the X (horizontal) axis. In other words, the rotation of the ellipse is fixed at 0 degrees.
'Y': Causes the ellipse to be rotated about its center of the minor axis in such a way that the major axis is parallel to the Y (vertical) axis. In other words, the rotation of the ellipse is fixed at 90 degrees.
'F': Frees you from the X or Y mode. This option allows you to freely change the rotation of the ellipse by moving the cursor. The program is in this mode when the add ellipse option is first selected.
[ESC]: Aborts and erases the ellipse added during the current add ellipse operation.

3.2.8 LINE

The LINE option allows you to create one or more lines. In the 2D program a line is defined by two characteristic points:

1) The first endpoint of the line.
2) The second endpoint of the line.

The program will not draw a line until the first endpoint has been defined. The first endpoint is defined by moving the cursor to the desired location on the screen and then pressing the cursor button. Once the first endpoint has been defined and object tracking is enabled, the program will repeatedly draw a 'rubberband' line from the first endpoint to the present cursor location. Moving the cursor changes the line's length and rotation. When you are satisfied with the line's orientation, accept it by pressing the cursor button. Another line will then be drawn from the second endpoint of the previously created line to the present cursor location. This process will continue until you type the 'Q' character.

The LINE menu options available are:

'X': Causes the line to maintain a rotation of 0 or 180 degrees, which makes the line grow only along the X (horizontal) axis.
'Y': Causes the line to maintain a rotation of 90 or 270 degrees, which makes the line grow only along the Y (vertical) axis.
'F': Frees you from the X or Y mode. This causes the line to follow the movements of the cursor. The program is in this mode when the add line option is first selected.
'D': Allows you to redefine the first endpoint of the current line being drawn. Once the line is detached, continue on with normal line input.
'A': Causes an arrowhead to appear on one end of the line. Hitting the 'A' again will remove the arrowhead.
'T': Causes the line to become a template line. Hitting the 'T' again will turn off the template option.
'M': Causes a marker to be displayed at the midpoint of the line. Hitting the 'M' again will remove the marker.
'E': Removes the last accepted line. If 'E' is selected and no lines remain, then the program will abort the LINE option.
'Q': Saves the newly created line(s) in your workfile and returns to the ADD menu.
[ESC]: Aborts and erases all lines added during the current add line operation.

3.2.9 POLYGON

The POLYGON option allows you to create a regular polygon. In the 2D program a polygon is defined by two characteristic points:

1) This point defines the center of the circle within which the polygon is inscribed, and is essentially the center of the polygon.
2) This point defines the radius of the circle within which the polygon is inscribed, and is essentially the radius of the polygon.

When this option is selected, the program will first ask how many sides the polygon will have. A polygon can have from three to 30 sides.

The program will not draw a polygon until the center has been defined. The center is defined by moving the cursor to the desired location on the screen and then pressing the cursor button. Once the center has been entered and object tracking is enabled, the program will repeatedly draw a polygon. Moving the cursor about the center of the polygon will change the radius of the polygon. Moving away from the center will cause the polygon to grow, moving towards the center will cause it to shrink. The polygon can also be rotated by moving the cursor around the center. When you are satisfied with the size and rotation of the polygon, accept it by pressing the cursor button.

The POLYGON menu options available are:

'X': Causes the polygon to maintain a rotation of 0 or 180 degrees, which makes the polygon grow only along the X (horizontal) axis.
'Y': Causes the polygon to maintain a rotation of 90 or 270 degrees, which makes the polygon grow only along the Y (vertical) axis.
'F': Frees you from the X or Y mode. This causes the polygon to follow the movements of the cursor. The program is in this mode when the add polygon option is first selected.
'T': Causes the polygon to become a template polygon. Hitting 'T' again will turn off the template option.
'M': Causes a marker to be displayed at the center of the polygon. Hitting the 'M' again will remove the marker.
[ESC]: Aborts and erases the polygon added during the current add polygon operation.

3.2.10 RECTANGLE

The RECTANGLE option allows you to create a rectangle. In the 2D program a rectangle is defined by two characteristic points:

1) One corner of the rectangle.
2) The opposite corner of the rectangle.

The program will not draw a rectangle until the first corner has been defined. The first corner is defined by moving the cursor to the desired location on the screen and then pressing the cursor button. Once the first corner has been defined and object tracking is enabled, the program will repeatedly draw a rectangle. The first corner is now permanently fixed, and all that needs to be defined is the opposite corner. Moving the cursor changes the location of the opposite corner. When you are satisfied with the size of the rectangle, accept it by pressing the cursor button.

The RECTANGLE menu options available are:

'T': Causes the rectangle to become a template rectangle. Hitting 'T' again will turn off the template option.
'M': Causes a marker to be displayed at the center of the rectangle. Hitting the 'M' again will remove the marker.
[ESC]: Aborts and erases the rectangle added during the current add rectangle operation.

3.2.11 POINT

The POINT option allows you to add one or more points to your drawing. In the 2D program a point is defined by one characteristic point:

1) The location of the point.

If object tracking is enabled, the program will repeatedly draw a point. Moving the cursor changes the location of the point. When you are satisfied with the position of the point, accept it by pressing the cursor button. Be aware that a point will always be plotted as a single dot. Also, a point will not be drawn or plotted if it is assigned the template property and the global template switch is turned off.

The POINT menu options available are:

'E': Causes the last accepted point to be erased. If 'E' is pressed and no points remain, the program will return to the ADD menu.
'T': Causes the point to become a template point. Pressing 'T' again will turn off the template option.
'M': Causes a marker to be displayed at the point's current position. Pressing 'M' again will remove the marker.
'Q': Causes all points entered so far to be saved in the workfile. The program will return to the ADD menu.
[ESC]: Aborts and erases all points added during the current add point operation.

3.2.12 TEXT

The TEXT option allows you to create and place multiple lines of text on your drawing. In the 2D program text is defined by one characteristic point:

1) This point defines the starting point of the text. It is the lower left hand corner of the text.

When this option is selected, the program will respond with the following message:

```
Press [RETURN] to quit, [ESC] to abort
ADD TEXT (60 char max):
```

Type a line of text from the keyboard. The maximum amount of characters allowed per text entry is 60. When you have finished typing in your text, accept it by hitting the [RETURN] key and the actual text will be drawn. If you made any mistakes while typing, you can edit the text. Hitting the [BS] key will delete the last character typed. Hitting the [ESC] key will abort the current add text operation. It is important to note that when the [ESC] key is pressed, the program will remove all lines of text added during the current ADD TEXT operation.

Once the line of text has been entered, position it by moving the cursor to the desired location and pressing the cursor button. After entering its position the program will again ask you to enter another line of text from the keyboard as described above.

When you are done adding lines of text, press ONLY the [RETURN] key when asked to enter another line of text.

After each line of text has been entered, the menu options available are:

'R': Causes the text to be rotated by the amount of degrees specified by the incremental rotation field off the UNITS menu.
'Q': Causes the program to quit out of the current add text mode and save all lines of text just entered.
[ESC]: Aborts and erases all text lines added during the current add text operation.

3.2.13 DIMENSION

The DIMENSION option allows you to dimension any item on the screen. In the 2D program a dimension line is defined by three characteristic points:

1) This point defines the first endpoint on the item that you are dimensioning.
2) This point defines the second endpoint on the item that you are dimensioning.
3) This point defines the height of the demension, or in other words, it defines the length of the leader lines of the dimension.

The program will not draw a dimension line until the first two characteristic points have been defined. These points are defined by moving the cursor to the desired locations on the screen and then pressing the cursor button. Once these two points have been defined and object tracking is enabled, the program will repeatedly draw a dimension line. Now, moving away from the object lengthens the leader lines, and moving closer shortens them. You can flip the height by moving on the other side of the item being dimensioned. The two endpoints just entered are fixed, and cannot be changed. When you are satisfied with the size of the dimension, accept it by pressing the cursor button.

As soon as you accept the dimension, the program will generate a text displaying the numeric value of the dimensioned distance. Moving the cursor will move this text. When you are satisfied with the placement of the text, accept it by pressing the cursor button.

You will note that the dimension leader lines will not touch the object being dimensioned. Rather, the dimension leader lines will be 1/16" away from the object when they are plotted. Also, the arrowheads on the dimension bar will be plotted at a length of 5/32" and have an included angle of 15 degrees.

The DIMENSION menu options available are:

'X': will measure the horizontal distance of the object.
'Y': will measure the vertical distance of the object.
'T': will measure the true length of the object. The program is in this mode when the add dimension option is first selected.
'L': causes the leader lines to be turned off. If the 'L' key is pressed again, then the leader lines will be turned on.
[ESC]: Aborts and erases the dimension added during the current add dimension operation.

The DIMENSION TEXT menu options available are:

'X': Causes the dimension text to maintain a rotation of 0 degrees.

'Y': Causes the dimension text to maintain a rotation of 90 degrees.

'R': Causes the dimension text to be rotated by the amount of degrees specified by the incremental rotation field off the UNITS menu.

'T': Causes the dimension text to maintain the same angle as the dimension lines. The program is in this mode when the add dimension option is first selected.

'D': Causes the dimension to be represented as a decimal number. For example, 68.5930 would be a typical decimal measurement. Before producing the decimal dimension, the program will ask for the number of significant decimal digits. You must enter a number from 0 through 4. If you enter a '0', then the dimension will become 68. If you enter a '2', the dimension will become 68.59. The program is in this mode when the add dimension is first selected.

'F': Causes the dimension to be represented as feet and inches. For example, 68.5930 would be represented as 68'-7.1/8". The program will round the dimension to the nearest 1/16 inch.

'I': Causes the dimension to be represented as inches. For example, 68.5930 would be represented as 5'-8.9/16". The program will round the dimension to the nearest 1/16 inch.

'E': Allows you to override what the program produces as the dimension text. The program will ask you to enter what you want the dimension to be. Enter up to 60 characters followed by the [RETURN] key.

'Q': Causes the dimension text to be thrown away and only use the dimension lines. When this option is selected, the program will leave the dimension option.

[ESC]: Aborts and erases the dimension and dimension text added during the current add dimension operation.

3.2.14 GROUP

The GROUP option allows you to add one or more groups to your drawing from the current library.

A group is a collection of primitive objects, such as lines and circles that make up a complex figure. Once a group is defined, it is placed in a group library. Typically, a group is specific to a particular application and is used over and over again. For example, the figure of a resistor is used frequently in electrical schematics and is therefore a good candidate for a group.

Each and every object within a group can be individually modified if necessary. The only element of commonality that all of the objects in a group share is their group name. For example, in the case of the resistor, it is the group name that links a bunch of primitive lines into a meaningful configuration.

In order to use the GROUP option, you must first have a group library on a library disk. In addition, you should have the current library's group overlay secured to the surface of your digitizer. Refer to the LIBRARY option described in this manual for instructions on how to make a library and its group overlay.

A group is defined by two characteristic points:

1) The first point entered selects the group to add.
2) The second point entered defines the placement of the group.

When this option is selected, the program will display the following message:

```
Place the library disk into drive #5
Press [RETURN] to continue
```

The program is now waiting for you to swap disks if necessary. For example, you may have to remove the 'CODE' disk and insert the current library disk. When you are ready to continue, press the [RETURN] key.

Next, the program will ask you to select a group from the library overlay. A group can be selected in one of two ways. If your graphics input device is currently set to DIGITIZER, then the group is selected by placing the cursor over the desired group picture on the group overlay and pressing the cursor button. If your graphics input device is currently set to JOYSTICK, then the group is selected by typing in its number on the group overlay.

As soon as you have selected the group, the program will transfer the necessary group information (all of the objects that make up that group) to the workfile. If object tracking is enabled, the program will repeatedly display the group. Moving the cursor will move the group, changing its location on the screen. When you are satisfied with the orientation of the group, accept it by pressing the cursor button. The program will now ask that you select another group and repeat the process just described (as long as you are in the GROUP option, you will not have to swap disks). When you are finished adding groups, press the 'Q' key and the program will return to the ADD menu.

The GROUP menu options available are:

'I': Causes the group to be imaged about the Y-axis. This option is used to change the orientation of the group.

'R': Causes the group to be rotated by the amount of degrees defined by the INCREMENTAL ROTATION field off the UNITS menu. This option is used to change the orientation of the group.

'F': Allows you to scale the group by entering a numeric scaling factor.

'O': Overrides causes all of the property values stored with the objects in the group to be overridden. It causes the objects in the group to assume the currently defined property values shown off the PROPERTIES menu. Pressing 'O' again will turn off the OVERRIDE option and the objects of the group will retain their original properties. When override is active, the rules for override are:

1. The objects in the selected group will never inherit the current group name property. This group name change must be done using the NAME option.
2. The objects will always inherit the current level, linestyle, plotter pen number, and density properties.

'N': Allows you to change the name of the group selected from the current library. If you imbed the character sequence '...' in the group name, then the program will automatically number the group. For example, if the group name entered was 'DOOR...', then the program will assign the group the name 'DOOR1'. The next time the group is selected, the program might assign it the group name 'DOOR5'. If the character sequence is not imbedded in the group name, then the program will assign all of the objects in the group that name. It is recommended that you imbed this sequence in the group name so that the program will assign each group added to your drawing a unique group name. This is to allow for easy identification of a group for future modification.

'E': Causes the last group added to be erased. The currently selected group will be erased and you will be instructed to select another.

'Q': Saves all of the newly added groups in your workfile and returns you to the ADD menu.

[ESC]: Aborts and erases all groups added during the current add group operation.

It is important to note that each time a group is selected from the current library and added to your drawing, the program duplicates all of the objects that make up that group. Thus if the group selected requires 10 objects to make and you added 10 of these groups to your drawing, then you have just used 100 records in your workfile.

3.2.15 UPDATE PROPERTIES

The UPDATE PROPERTIES option allows you to change the global properties and the smallest increment.

When you select this option, the program will display the current global properties. For example, a typical display may look like the following:

```
S: 1      D: 1      N: N1
P: 3      L: 5      I: 0.1250
Change what field?
```

Once the properties are displayed, you will be expected to select the global property that you want to update. It is important to note that changing the properties using this option also changes the properties found on the PROPERTIES menu off the MAIN MENU. In other words, the UPDATE option provides a quicker method of inquiring and changing the global properties.

For example, a line needs to be added to the drawing. The line must be placed into the group 'N2'. So, instead of using the PROPERTIES menu to change the global group name property, you can use the UPDATE PROPERTIES option off the ADD menu. Select the UPDATE option and type 'N' for group name. The program will position you for entry of the new global group name property. Enter the name followed by the [RETURN] key. Now, when the line is added to the drawing, it will take on the new group name property of 'N2'.

Press the [ESC] key to abort the UPDATE PROPERTIES option and leave all global properties unchanged. Press either the 'Q' or the [RETURN] key to leave the update properties option and return to the ADD menu.

3.2.16 SKETCH

Refer to section 3.19 of this manual for a description of the SKETCH option.

3.2.17 QUIT

This option allows you to leave the ADD menu, and return to the 2D program MAIN MENU.

3.3 MODIFY

3.3.1 FUNCTION SELECTION

The MODIFY option can be reached by choosing the 'M' character from the 2D program MAIN MENU.

The MODIFY menu looks like this:

```
MODIFY:
 [C] Copy
 [M] Move
 [S] Scale
 [R] Rotate
 [I] Image
 [X] eXplode
 [D] Delete
 [U] Undelete
 [H] Handle
 [E] Edit Text
 [P] object Properties

 [F] Find                    [K] sKetch
 [<] move backward           [Q] Quit
 [>] move forward            [?] Help
```

3.3.2 PURPOSE

The MODIFY option allows the user to graphically manipulate any of the objects currently displayed on the screen.

Many times a drawing may not look exactly right. For example, a circle may need to be moved, a line may need to be rotated, or a rectangle may need to be copied. In all of these cases, the MODIFY option provides the means to produce the desired results.

3.3.3 DATA ENTRY

The 2D program maintains a list of all the objects in a drawing. When objects are created, they are added to the end of the list. When you enter the MODIFY menu from the main menu, the program will point to the last object in the list figuring that you want to modify the object that you last added.

The program must point to the object that is to be modified. So, how do you know that the program is pointing to the object that you want to modify? Simply turn on object tracking mode and the program will begin to blink an object. The program is pointing to this object. This object will continue to blink until you turn off object tracking or tell the program to point to another object.

It is important to note that the object the program is pointing to will not blink at all if the object tracking mode is not on.

Using the '>' or '<' keys allows you to go forward or backward through the list of objects. The list is 'circular', i.e., if you hit the '>' key enough times, you will reach the end of the list. But, the program will not stop there. It will wrap around to the beginning of the list, and point at the first object in the list. Eventually you will arrive at the desired object. These arrow keys allow you to tell the program at what object to point and blink.

An option available as an alternative to using the '<' and the '>' keys is FIND. This option requires that you move the cursor to any point on the object you wish to modify, and 'find' it by pressing the cursor button. The program will then search through the drawing in order to find it and then point at that object by blinking it. This provides a much faster means of choosing the object to be modified.

If the program ever points to a text string, then it will automatically convert it to two parallel lines in order to speed-up the MODIFY operations. The program will automatically convert the text back to characters when it no longer points to it.

Hitting the [ESC] key while in any MODIFY option immediately aborts that option and returns to the MODIFY menu. For example, if you were rotating a line and hit the [ESC] key, then the program will abort the ROTATE option and restore the line to its original orientation.

Handles are used frequently by the MODIFY options. The handle point is that with which you can move, from which you can scale or about which you can rotate an object. The handle is a known reference point on the object. To change the handle point refer to section 3.3.12 of this manual.

3.3.4 COPY

The COPY option allows you to make one or more copies of an object.

When this option is selected, the object pointed to by the program will be duplicated. If the copy is blinking, then it will follow the cursor across the screen. The copy is always attached to the cursor by its handle point. Position the cursor to the desired location, and accept the copied object by pressing the cursor button. Once accepted, another copy is produced, and will follow the cursor across the screen. Again, position the cursor, and accept the copied object. This feature allows you to produce multiple copies with minimal effort.

When you have made all of your copies, simply press the 'Q' key. All of your copies will then be stored in your workfile. If you have accepted copies of the blinking object, but wish to have them all removed, simply press the [ESC] key.

The COPY menu options available are:

'R': The REPEAT option allows you to copy an object using a variety of repeating methods. When this option is selected, the program will display the following menu:

COPY REPEAT:

[O] One direction
[T] Two directions
[C] Circular
[Q] Quit

At this time you must decide which method you will use to copy the object. The following three methods are available: ONE DIRECTION copy, TWO DIRECTIONS copy and CIRCULAR copy. These methods are very similar in operation to htose on the COPY menu off the GROUP menu. Press the appropriate key to select the desired copy operation.

ONE DIRECTION: The ONE DIRECTION option allows you to create a variable number of copies along a single axis. When this option is selected, the program will display the following message:

Total number of copies:

You are required to enter the total number of copies desired followed by the [RETURN] key. The total number of copies must include the original object in the count. Next, the program will ask that you move the cursor to define the change in direction of the copies. Accept this position by pressing the cursor button. The program will draw the copied objects along a single axis.

TWO DIRECTIONS: The TWO DIRECTIONS option allows you to create a two-dimensional matrix of copies. When this option is selected, the program will display the following message:

Total copies in X direction:

Total copies in Y direction:

You are required to enter the total number of copies desied in the X direction and the total number of copies desired in the Y direction. Each total entered must include the original object in the count. Next, the program will ask that you move the cursor to define the change in the X direction of the copies. Accept this position by pressing the cursor button. Now, move the cursor to define the change in the Y direction of the copies. Accept this position by pressing the cursor button. The program will draw the copied objects in the form of an X-Y matrix.

CIRCULAR: The CIRCULAR option allows you to create a variable number of copies in a circular fashion. When this option is selected, the program will display the following message:

```
Incremental rotation:    90.0000
Total number of copies:  4
Object rotation:         90.0000
```

You are required to enter three pieces of information. First, you must enter the incremental rotation or angular offset (in degrees) between each of the copies. Second, you must enter the total number of copies desired, including the original object. Third, you must enter the object rotation or angular offset (in degrees) to be applied to each copy (usually, this is the same angle as the incremental rotation). Next, the program will ask that you define the center point of the copies. This is the point about which the copies will be rotated in a circular fashion. Move the cursor to the center point. Accept this position by pressing the cursor button. The program will draw the copied objects in the form of a circle about the center point.

QUIT: The QUIT option allows you to return to the COPY menu.

'H': Changes the handle point for those objects that have two handle points.

'M': Causes the object's markers to be drawn. Press 'M' again will turn off the markers.

'E': Causes the last accepted copy of the object to be erased. If 'E' is selected and no copies remain, the program will return to the MODIFY menu.

'Q': Causes all of your copies to be stored in the workfile and returns you to the MODIFY menu.

[ESC]: Aborts the COPY option and erases all copies made during the current copy operation.

3.3.5 MOVE

The MOVE option allows you to move an object across the screen.

When you select this option, the handle point of the object pointed to by the program will move with the cursor, dragging the object with it. When you are satisfied with the new location of the object, accept it by pressing the cursor button. It now remains fixed in its new location. Pressing the [ESC] key returns the object to its original location.

The MOVE menu options available are:

'H': Changes the handle point for those objects that have two handle points.
'M': Causes the marker to be displayed at the object's default handle point. Hitting the 'M' again will remove the marker.
[ESC]: Aborts the MOVE option and erases all copies made.

3.3.6 SCALE

The SCALE option allows you to change the scale (or size) of an object.

The same scaling factor is applied in both the X and Y directions, so the object is not distorted when scaled. Each object is scaled by fixing a stationary point and then scaling by pulling a handle point on the object.

When you select this option, moving the cursor will scale the object relative to its handle point. You can only scale the object by moving the cursor along the object's handle. Hitting the [ESC] key returns the object to its original size.

The SCALE menu options available are:

'H': Changes the handle point for those objects that have two handle points.
'M': Causes the marker to be displayed at the object's default handle point. Hitting the 'M' again will remove the marker.
'F': Allows you to enter a numeric scaling factor from the keyboard.
[ESC]: Aborts the SCALE option and returns to the MODIFY menu.

3.3.7 ROTATE

The ROTATE option allows you to rotate an object.

When this option is selected, the object pointed to by the program will rotate about its handle point as guided by the movements of the cursor. The object's size will not change, and its handle point will remain fixed. When the object is rotated correctly, accept it by pressing the cursor button. Hitting [ESC] returns the object to its original position.

The ROTATE menu options available are:

'H': Changes the handle point for those objects that have two handle points.
'M': Causes the marker to be displayed at the objects default handle point. Hitting the 'M' again will remove the marker.
[ESC]: Aborts the ROTATE option and returns to the MODIFY menu.

3.3.8 IMAGE

The IMAGE option allows you to create a mirror image of an object about a given line.

When this option is selected, the program will display a blinking horizontal line on the screen. This is the image line. The image line is the line about which the object will be imaged. This line can be vertical, horizontal, rotated at any angle and can be moved anywhere on the screen. When the image line is positioned correctly, accept it by pressing the cursor button. The program will then draw the imaged object.

The IMAGE menu options available are:

'X': Causes the image line to become horizonatal. The program is in this mode when the IMAGE option is first selected.
'Y': Causes the image line to become vertical.
'R': Causes the image line to rotate about a fixed point. The position of the cursor just prior to selecting 'R' will be the point about which the image line is rotated. Once you select 'R', moving the cursor will no longer move the image line but will cause it to rotate about the fixed point instead.
'M': Causes the image line to follow the cursor across the screen. The angle of the image line will not be changed. If you were rotating the image line, selecting 'M' will fix the angle of the line and moving the cursor will no longer cause the line to rotate. The program is in this mode when the IMAGE option is first selected.
'P': Fixes the location of the image line and allows the cursor to move freely around the screen.
'C': Allows you to switch between imaging the object, and imaging a copy of the object.
[ESC]: Aborts the IMAGE option and returns to the MODIFY menu.

3.3.9 EXPLODE

The EXPLODE option allows you to explode an object into a set of line segments.

When this option is selected, the program will explode the object pointed to by the program into a set of continuous line segments. These line segments are added to the workfile as individual LINES. Thus, once an object has been exploded, each of the individual line segments produced can then be modified.

For example, if a five sided polygon is exploded, then the original polygon will be deleted from the workfile. In its place, five line segments will be added to the end of the workfile. The program will then point to the first of these five line segments anticipating that a modification will be necessary.

Even a line can be exploded. It will be broken at its midpoint into two identical lines, each 1/2 the size of the original. This allows you to trim a line in order to insert other objects.

The original object remains in your workfile, but is no longer associated with your drawing. The UNDELETE option (see section 3.3.11) allows you to return this object to your drawing.

3.3.10 DELETE

The DELETE option allows you to delete an object from the drawing.

When this option is selected, the program will delete the object from the screen. The object remains in your workfile, but is no longer associated with your drawing. The UNDELETE option (see section 3.3.11) allows you to return this object to your drawing.

3.3.11 UNDELETE

The UNDELETE option allows you to undelete (or recover) objects that have been previously deleted.

When this option is selected, the program will look for any objects that have been previously deleted. If it does not find any, it will immediately leave the UNDELETE option, and return to the MODIFY menu. However, if it does find some deleted objects, it will respond with:

```
UNDELETE:
 [Y] Yes
 [N] No
 [Q] Quit
```

Once this menu has been displayed, the program will repeatedly draw the deleted object and wait for your response. Typing a 'Y' will cause the program to undelete the object and return it to your drawing. Typing a 'N' will cause the program to skip over this deleted object, and blink the next deleted object. Typing a 'Q' tells the program to quit undeleting and return to the MODIFY menu.

3.3.12 HANDLE

The HANDLE option allows you to change the 'handle' of the object pointed to by the program.

The following is an example of the HANDLE option's usefulness. Suppose you wish to scale a rectangle, and find that you are scaling it from the wrong corner. By choosing the HANDLE option, you can switch the rectangle's handle to the opposite corner. This will then allow you to scale it correctly.

The object's handle will be switched only if it has two handle points. For a list of those objects that have two handle points see section 2.23.

3.3.13 EDIT TEXT

The EDIT TEXT option allows you to edit text on the graphics screen. The text on the screen must be pointed to by the program.

When this option is selected, the program will display:

```
Edit text (60 char max):
(actual text displayed here)
```

The program will display the text that is to be edited towards the bottom of the screen and below the prompt as shown above. You are limited to 60 characters per text string.

Enter the new text from the keyboard. Typing the [BS] key will erase one character from the end of the text. Typing the [ESC] key will abort the operation and redisplay the original text. Typing the [RETURN] will accept the new text.

3.3.14 OBJECT PROPERTIES

Refer to section 3.4 of this manual for a description of OBJECT PROPERTIES.

3.3.15 FIND

The FIND option allows you to quickly select the object that is to be modified. It is a means of telling the program to point to a specific object.

The object is selected by moving the cursor to any point on the object. Once the cursor is on the object, accept it by pressing the cursor button. The program will then search through your drawing looking for the object. It can take a few seconds for the program to find your object, especially if the drawing has many objects. When it has completed its search, it will blink the object if object tracking is on.

The program allows you to be about three screen dots away from an object and still find it. If the wrong object starts blinking, then you were not close enough to your target object. It is important to note that when you place the cursor near the desired object, try not to place the cursor near any other objects as well. The program will have an easier time finding the correct object.

3.3.16 MOVE BACKWARD AND MOVE FORWARD

The MOVE BACKWARD and MOVE FORWARD options allow you to step through the list of objects in your drawing.

These two keys provide a means of sequentially stepping through the objects in your workfile until you find the one that you wish to modify. Each time that you press the MOVE BACKWARD ('<') or MOVE FORWARD ('>') keys you will move one object forward or backward in the list.

If object tracking is on, you will notice that an object is blinking on the screen. When you select the MOVE FORWARD key, this object will stop blinking, and another one will start to blink. The object now blinking was 'forward' in the list of objects. Now, select the MOVE BACKWARD key. Notice that the previously blinking object is again blinking. Hit the MOVE BACKWARD again, and notice that this object stops blinking, and a new one begins to blink. The object now blinking was 'backward' in the list. If the blink mode was not enabled, then the new object pointed to will only blink once.

3.3.17 SKETCH

Refer to section 3.19 of this manual for a description of the SKETCH option.

3.3.18 QUIT

The QUIT option allows you to exit the MODIFY option, and return to the 2D program MAIN MENU.

3.4 OBJECT PROPERTIES

3.4.1 FUNCTION SELECTION

The OBJECT PROPERTIES menu can be reached by choosing the 'P' character on the MODIFY menu.

The OBJECT PROPERTIES menu looks like:

```
OBJECT PROPERTIES:
                      CURRENT   PROPOSED
  [S] lineStyle:
  [D] Density:
  [L] Level:
  [P] Pen:
  [N] group Name:
  [R] Rotation:
  [W] Width
  [H] Height:
  [A] Arrow:
  [T] Template:
  [M] Marker

  [F] Find                  [G] Global properties
  [<] move backward         [C] Clear proposed
  [>] move forward          [U] Update properties

  [Q] Quit                  [?] help
```

3.4.2 PURPOSE

The OBJECT PROPERTIES option allows you to change the properties of an object.

A property can be thought of as an attribute or characteristic of an object. All primitive objects have several properties. For example, two properties of a line are: a group name of 'N1' and a plotter linestyle of 3.

Using the OBJECT PROPERTIES option you can selectively change one or more of the properties of any object. For example you can change the plotter pen number of an object from 2 to 3.

The object that is eligible for changing is the one that is currently pointed to by the program. If object tracking is on, then this object will be blinking. You can move through the list of objects and change the object pointed to by using the FIND, MOVE BACKWARD and MOVE FORWARD commands.

The basic idea behind the OBJECT PROPERTIES option is that you change an object's properties by creating a list of proposed changes, and then change the current values of the object to the proposed values all at once. Once you have created a list of proposed changes, you can update the properties of any number of objects by typing a single key for each object.

3.4.3 DATA ENTRY

When you select the OBJECT PROPERTIES option, the program will list all of the object's properties on the left hand side of the screen. The list is broken down into two columns; a 'CURRENT' column which contains the current values of all the object's properties, and a 'PROPOSED' column which contains the proposed new values for those properties. Initially, the 'PROPOSED' column is blank. An example is shown below for a typical line:

```
                        CURRENT     PROPOSED
  [S] lineStyle:          1
  [D] Density:            1
  [L] Level:              1
  [P] Pen:                1
  [N] group Name:         ONE
  [R] Rotation:           90.0000
  [W] Width:              n/a
  [H] Height:             n/a
  [A] Arrow:              No
  [T] Template:           No
  [M] Marker:             No
```

When an option in the OBJECT PROPERTIES menu is selected, the program positions you to enter the new proposed value of that property. After you have entered the new value it will be displayed in the 'PROPOSED' column. In the example below, new values have been proposed for both the plotter linestyle and the plotter pen number. The proposed value for the linestyle is 3 and the proposed value for the pen is 2.

```
                        CURRENT     PROPOSED
  [S] lineStyle:          1           3
  [D] Density:            1
  [L] Level:              1
  [P] Pen:                1           2
  [N] group Name:         ONE
  [R] Rotation:           90.0000
  [W] Width:              n/a
  [H] Height:             n/a
  [A] Arrow:              No
  [T] Template:           No
  [M] Marker:             No
```

It is important to remember that the proposed values are just that, proposed. The current values are not changed to the proposed values until the UPDATE PROPERTIES option is selected. When the UPDATE PROPERTIES option is selected, the object's 'CURRENT' properties will be changed to the 'PROPOSED' values. Properties with no 'PROPOSED' changes will not be changed. In the example above, the object's plotter linestyle will be changed to 3, and it's plotter pen number to 2. All other properties of the line will remain unchanged.

3.4.4 LINESTYLE

The LINESTYLE option allows you to change the plotter pen linestyle property of an object.

For example, the linestyle number of a particular circle can be changed from 4 to 2 using the LINESTYLE option. This option is only meaningful for those plotters that support different linestyles. It is suggested that you experiment with the various linestyles to determine the most appropriate one to use.

When you select this option the program will ask you to enter the new linestyle value. Enter the desired linestyle number and then hit the [RETURN] key. Hitting [RETURN] without entering a new number will keep the old linestyle. When the proposed property changes are made permanent, the program will draw the object using the new linestyle.

3.4.5 DENSITY

The DENSITY option allows you to change the number of times that the plotter will overstrike each line in an object.

For example, if you set the density of a particular rectangle to 3, then each line of the rectangle will be drawn 3 times when the rectangle is plotted.

When you select this option the program will ask you to enter the new density value. Enter the desired number and then hit the [RETURN] key. Hitting [RETURN] without entering a new number will keep the old density value.

3.4.6 LEVEL

The LEVEL option allows you to change the level property of an object.

For example, if an object is in level 1, selecting the LEVEL option allows you to put the object into level 3 instead.

When you select this option the program will ask you to enter the new level number. Enter the desired number and then hit the [RETURN] key. Hitting [RETURN] without entering a new number will keep the old level number.

3.4.7 PEN

The PEN option allows you to change the plotter pen property of an object.

For example, the plotter pen number of any object can be changed from 1 to 2 using the PEN option. This option is only meaningful for those plotters that support multiple pens.

When you select this option, the program will ask you to enter the new pen number. Enter the desired number then hit the [RETURN] key. Hitting [RETURN] without entering a new pen number will keep the old value.

3.4.8 GROUP NAME

The GROUP NAME option allows you to change the group name property of an object.

For example, if an object is in group 'ONE' and you want to remove it from that group and add it to group 'TWO', you should use the GROUP NAME option to change the group name.

When you select this option the program will ask you to enter the new group name. Enter the new name (7 character maximum) and hit the [RETURN] key. Hitting [RETURN] without entering a new name will keep the old group name.

3.4.9 ROTATION

The ROTATION option allows you to change the rotation of an object.

As an example, if a text object has a rotation of 0 degrees and you would like it to be rotated to 90 degrees, use the ROTATION option to change its rotation from 0 to 90 degrees.

When you select this option the program will ask you to enter the new rotation. Enter the desired rotation (in degrees) and hit the [RETURN] key. Hitting [RETURN] without entering a new rotation will keep the old rotation.

3.4.10 WIDTH

The WIDTH option allows you to change the character width of a text object.

The character text width defines how wide a single character is. The width is always in terms of real world coordinates. For example, if your drawing ranges from 0 - 10 feet in the X direction and 0 - 8 feet in the Y direction, a character text width of 1 will cause each character's width to be 1 foot.

When you select this option the program will ask you to enter the new text width. Enter the desired number (which can be a real number) and hit the [RETURN] key. Hitting [RETURN] without entering a new number will keep the old text width.

3.4.11 HEIGHT

The HEIGHT option allows you to change the character height of a text object.

The character text height defines how high a single character is. The height is always in terms of real world coordinates. For example, if your drawing ranges from 0 - 10 feet in the X direction and 0 - 8 feet in the Y direction, a character text height of 1 will cause each character's height to be 1 foot.

When you select this option the program will ask you to enter the new text height. Enter the desired number (which can be a real number) and hit the [RETURN] key. Hitting [RETURN] without entering a new number will keep the old text height.

3.4.12 ARROW

The ARROW option allows you to add or remove an arrowhead from an object.

For example, if you want a particular line to have an arrowhead, select the ARROW option and type 'Y'. If you wish to remove the arrowhead from an object, then type 'N'. This option is meaningful for those objects that allow arrowheads, such as lines and bezier curves.

When you select this option the program will position you to enter either a 'Y' (for yes, add an arrowhead) or an 'N' (for no arrowhead). Type in the desired value. Typing any keys other than 'Y' or 'N' will cause the program to keep the old value.

3.4.13 TEMPLATE

The TEMPLATE option allows you to change whether or not an object is to be drawn as a template object.

For example, if you want a particular object to become a template object, select the TEMPLATE option and type 'Y' to the question.

When you select this option the program will position you to enter either a 'Y' or an 'N'. Type in the desired value. Typing any keys other than 'Y' or 'N' will cause the program to keep the old value.

3.4.14 MARKER

The MARKER option allows you to change whether or not an object's center marker is to be shown.

For example, if you want a marker placed at the center of a circle, then use the FIND option to make the circle blink. Select the MARKER option and press the 'Y' key.

3.4.15 GLOBAL PROPERTIES

The GLOBAL PROPERTIES option allows you to setup a 'PROPOSED' column containing all the global property values.

When you select this option the program will display in the 'PROPOSED' column all of the global properties that are defined on the PROPERTIES menu located off the MAIN MENU. The current properties of the object will NOT be changed to the proposed properties until the UPDATE PROPERTIES option is selected.

3.4.16 CLEAR PROPOSED

The CLEAR PROPOSED option clears the 'PROPOSED' column of any changes.

You should select this option anytime you want to clear the 'PROPOSED' column. For example, you might want to do this if you made a mistake and changed several of the wrong proposed properties.

3.4.17 UPDATE PROPERTIES

The UPDATE PROPERTIES option actually sets and makes permanent all the changes listed in the 'PROPOSED' column.

As an example, suppose you have the following displayed on your screen:

	CURRENT	PROPOSED
[S] lineStyle:	1	3
[D] Density:	1	
[L] Level:	1	
[P] Pen:	1	2
[N] group Name:	ONE	
[R] Rotation:	90.0000	
[W] Width:	n/a	
[H] Height:	n/a	
[A] Arrow:	No	
[T] Template:	No	
[M] Marker:	No	

Selecting UPDATE PROPERTIES at this time will change the linestyle of the blinking object to 3 and the pen number to 2. All other properties of the object will remain unchanged.

After changing the properties, the UPDATE PROPERTIES option causes the 'next' object on the screen to blink (as if you had hit the MOVE FORWARD key). This feature allows you to repeatedly select the UPDATE PROPERTIES option to change the properties of several objects.

3.4.18 FIND

Refer to section 3.3.15 in this manual for a description of the FIND option.

3.4.19 MOVE BACKWARD and MOVE FORWARD

Refer to section 3.3.16 in this manual for a description of the MOVE BACKWARD and MOVE FORWARD option.

3.4.20 QUIT

The QUIT option exits the OBJECT PROPERTIES menu and returns you to the MODIFY menu.

3.5 GROUP

3.5.1 FUNCTION SELECTION

The GROUP menu can be reached by choosing the 'G' character on the 2D program MAIN MENU.

The GROUP menu looks like this:

```
GROUP:
 [C] Copy
 [M] Move
 [S] Scale
 [R] Rotate
 [I] Image
 [D] Delete
 [U] Undelete
 [W] Where
 [L] List
 [P] group Properties
 [F] Find
 [K] sKetch
 [Q] Quit
 [?] Help
```

3.5.2 PURPOSE

A 'group' is an arbitratry, user defined collection of objects. Groups provide a convenient way of manipulating the basic components of a complex drawing. Groups allow you to move, copy and otherwise manipulate large numbers of symbols at one time. Groups also provide a useful means of storing these complex figures on the disk, where they can then be used as components of future drawings. The options available on the GROUP menu allow you to perform these tasks.

A group is identified by an arbitrary name that you define. When you start a drawing from scratch, all objects that you create are assigned the global default group name. This global name can be changed using the PROPERTIES option on the main menu. Objects within a drawing may form logical groupings. For example, a small portion of the overall drawing may consist of several objects grouped to form a piping of electrical network. You may at some time wish to move, copy or scale this network. By giving all of the objects within the network the same group name, you can work with this collection as a group.

3.5.3 DATA ENTRY

Most options on the GROUP menu require the entry of a group name. This is necessary so that the program will know which group is to be modified. For example, if you wish to move a group, the program will respond with:

Group name (7 chars max): (default group name)

Enter a seven character group name followed by the [RETURN] key. While entering the name you may hit the [ESC] key to abort the GROUP option chosen. If you want to use the group name shown, then only hit the [RETURN] key in response. This feature allows you to work with the same group repeatedly without having to reenter the name. Once the group name has been entered, the program will continue on with the particular option chosen.

When the group name has been entered, the program will attempt to verify that that particular group exists in your workfile. If it does exist, the program will continue on with the selected option. If it does not exist, the program will display the following message:

Group does not exist

Hitting the [ESC] key while in any GROUP option immediately aborts that option and returns to the GROUP menu.

Trying to remember the names of all the different groups in your drawing is a very difficult task. The FIND option off the GROUP MENU can help make this task a little easier. For example, instead of memorizing the names of groups, select the FIND option and let the program find the group that you want to modify. Once the group has been found, the default group name will be changed to the desired group. So, the next time the program asks for a group name, all that you need to do is press the [RETURN] key.

While you are modifying a group, you will notice that sometimes a sub menu is displayed along the side of the screen. The options on this sub menu give you greater control over the selected GROUP option.

3.5.4 COPY

The COPY option allows you to copy a group using a variety of methods.

When you have entered the name of the group to be copied, the program will ask that you enter the group name to be assigned to the copies:

New group name: (default group name)

Where the (default group name) is the currently defined group. Enter the name (7 characters maximum) that you wish to call the copied group, followed by the [RETURN] key. If you wish to use the default group name, then hit only the [RETURN] key in response. The program will respond with the following menu:

If you imbed the character sequence '...' in the new group name, then the program will automatically number the copies. For example, if the original group name was 'DOOR' and the new group name entered was 'DOOR...', then the program will assign the first copy the group name 'DOOR1'. The second copy will be assigned the group name 'DOOR2', etc. If the character sequence '...' is not imbedded in the new group name, then the program will assign all of the copies the same group name. It is recommended that you imbed this sequence in the new group name so that the program will assign each new group a unique group name. This is to allow for easy identification of group for future modification.

COPY:

[S] Single
[O] One direction
[T] Two Directions
[C] Circular
[Q] Quit

At this time you must decide which method you will use to copy the group. The following four methods are available: SINGLE copy, ONE DIRECTION, TWO DIRECTIONS, and CIRCULAR. These methods are very similar in operation to those on the COPY menu off the MODIFY menu. Press the appropriate key to select the desired copy operation.

SINGLE: The SINGLE option allows you to make only one copy of a group. When this option is selected, you must first define the group's handle point. The handle is the point by which you will move the copied group. This point allows you to precisely align the copied group with any other part of your drawing. To define the handle point, position the cursor on the original group. Accept this position by pressing the cursor button. Now, move the cursor to define the new location of the handle point. Accept this position by pressing the cursor button. The program will draw the copied group at its new location.

ONE DIRECTION: The ONE DIRECTION option allows you to create a variable number of copies along a single axis. When this option is selected the program will display the following message:

Total number of copies:

You are required to enter the total number of copies desired followed by the [RETURN] key. The total number of copies must include the original group in the count. The program will ask you to define the handle of the group to be copied. The handle allows you to precisely align the copied groups on your drawing. To define the handle point, position the cursor on the original group. Accept this position by pressing the cursor button. Now, move the cursor to define the new location of the handle point. This point will define the change in direction of each copy. Accept this position by pressing the cursor button. The program will draw the copied groups along a single axis.

TWO DIRECTIONS: The TWO DIRECTIONS option allows you to create a two-dimensional matrix of copies. When this option is selected, the program will display the following message:

Total copies in X direction:
Total copies in Y direction:

You are required to enter the total number of copies desired in the X direction and the total number of copies desired in the Y direction. Each total entered must include the original group in the count. The program will ask you to define the handle of the group to be copied. The handle allows you to precisely align the copied groups on your drawing. To define the handle point, position the cursor on the original group. Accept this position by pressing the cursor button. Now, move the cursor to define the change in the X direction of the copies. Accept this position by pressing the cursor button. Now, move the cursor to define the change in the Y direction of the copies. Accept this position by pressing the cursor button. The program will draw the copied groups in the form of an X-Y matrix.

CIRCULAR: The CIRCULAR option allows you to create a variable number of copies in a circular fashion. When this option is selected, the program will display the following message:

Incremental rotation: 90.0000
Total number of copies: 4
Group rotation: 90.0000

You are required to enter three pieces of information. First, you must enter the incremental rotation or angular offset (in degrees) between each of the copies. Second, you must enter the total number of copies desired, including the original group. Third, you must enter the group rotation or angular offset (in degrees) to be applied to each copy (usually, this is the same angle as the incremental rotation). The program will ask that you define the center point of the copies. This is the point about which the copies will be rotated in a circular fashion. Move the cursor to the center point. Accept this position by pressing the cursor button. Next, move the cusor to define the handle point of the group. Accept this position by pressing the cursor button. The program draws the copied groups in the form of a circle about the center point.

QUIT: The QUIT option allows you to return to the GROUP menu.

3.5.5 MOVE

The MOVE option allows you to move a group.

When you have entered the name of the group to be moved, the program will ask:

Place cursor, and press button to enter handle point.

The 'handle' is the point by which you will move the group. This point allows you to precisely align the group with any other part of your drawing. Position the cursor over the handle point, and accept it by pressing the cursor button. Now move the cursor to the new location of the handle point. Accept this location by pressing the cursor button. The program will redraw the group at its new location.

3.5.6 SCALE

The SCALE option allows you to proportionately scale a group.

The same scaling factor is applied in both the X and Y directions, so the group is not distorted when scaled. The group is scaled by defining a fixed stationary point and then scaled by pulling a handle point on the group.

When you have entered the name of the group you wish to scale, the program will ask:

Place cursor, and press button to enter stationary point.

The 'stationary point' is the point that will remain stationary while scaling. Enter the stationary point by moving the cursor to the desired location and pressing the cursor button. Once this point has been entered, the program will ask:

Place cursor, and press button to enter handle point.

The 'handle' is the point that the cursor holds onto while you scale the group. Enter the handle by moving the cursor to the desired location and pressing the cursor button. Once the handle has been input, a blinking line will appear between these two points. This line represents the magnitude of the scaling and is called the scaling line. Moving the cursor will cause the scaling line to grow or shrink in size. Notice that the first two points entered have determined the rotation of the scaling line and cannot be changed. When the scale is correct, accept the group by pressing the cursor button and the program will draw the group to its new scale.

The keyboard options available while scaling are:

'F': Allows you to enter a numeric scaling factor from the keyboard.
[ESC]: Aborts the SCALE option and returns to the GROUP menu.

3.5.7 ROTATE

The ROTATE option allows you to rotate a group.

When you have entered the name of the group you wish to rotate, the program will ask:

Place cursor, and press button to enter pivotal point.

The 'pivotal point' is the point about which the group will be rotated. Enter the pivotal point by moving the cursor to the desired location and pressing the cursor button. The program will then respond with:

Place cursor, and press button to enter handle point.

The 'handle' is the point that the cursor holds onto while you rotate the group. Enter the handle by moving the cursor to the desired location and pressing the cursor button. Once the handle has been input, a blinking line will appear between these two points. This line is used to define the new rotation and is called the rotation line. Moving the cursor will cause the rotation line to rotate about the pivotal point. Notice that this rotation line represents a rotation relative to the position determined by the first two points entered. When you are satisfied with the rotation, accept it by pressing the cursor button and the program will draw the group in its new rotation.

3.5.8 IMAGE

The IMAGE option allows you to image a group about a given line.

When you have entered the name of the group to be imaged, the program will display a blinking horizontal line on the screen. This is the image line. The image line is the line about which the group will be imaged. This line can be vertical, horizontal, rotated at any angle and can be moved anywhere on the screen. When the image line is positioned correctly, accept it by pressing the cursor button. The program will then draw the imaged group.

When imaging, it is possible to request that the program produce imaged COPY of the specified group. This option produces two groups, the original and the imaged copy.

If the copy option is selected, the program will respond with:

New group name: (default group name)

Where the (default group name) is the currently defined group. Enter the name (7 characters maximum) that you wish to call the copied group, followed by the [RETURN] key. If you wish to use the default group name, then hit only the [RETURN] key in response. The program will then draw the imaged copy of the group.

If you imbed the character sequence '...' in the new group name, then the program will automatically number the imaged copy. For example, if the original group name was 'DOOR' and the new group name entered was 'DOOR...', then the program will assign the imaged copy the group name 'DOOR1'. If the character sequence '...' is not imbedded in the new group name, then the program will not automatically number the imaged copy. It is recommended that you imbed this sequence in the new group name so that the program will assign each new group a unique group name. This is to allow for easy identification of that group for future modification.

The keyboard options available while imaging are:

'X': Causes the image line to become horizontal. The program is in this mode when the IMAGE option is first selected.
'Y': Causes the image line to become vertical.
'R': Causes the image line to rotate about a fixed point. The position of the cursor just prior to selecting 'R' will be the point about which the image line is rotated. Once you select 'R', moving the cursor will no longer move the image line but will cause it to rotate about the fixed point instead.
'M': Causes the image line to follow the cursor across the screen. The angle of the image line will not be changed. If you were rotating the image line, selecting 'M' will fix the angle of the line and moving the cursor will no longer cause the line to rotate. The program is in this mode when the IMAGE option is first selected.
'P': Fixes the location and rotation of the image line and allows the cursor to freely move around the screen.
'C': Allows you to switch between imaging the group and imaging a copy of the group.
[ESC]: Aborts the IMAGE option and returns to the GROUP menu.

3.5.9 DELETE

The DELETE option allows you to delete a group from your drawing.

When you have entered the name of the group to be deleted, the program will delete it from your drawing and erase it from the screen. If the group does not exist, the program will respond with an appropriate message. To UNDELETE any previously deleted group, refer to section 3.5.10 of this manual.

3.5.10 UNDELETE

The UNDELETE option allows you to undelete (or recover) any group that has been previously deleted from your drawing.

When you have entered the name of the group that you wish to undelete, the program will look for the deleted group. If the deleted group does not exist, the program will respond with:

No deleted objects in this group.

If the program found the deleted group, it will return the group to the drawing.

3.5.11 WHERE

The WHERE option shows you where on the screen the requested group is located.

When this option is selected, the program will ask you to enter the name of the group that you wish to locate. Type in the appropriate name. The program will then search through the workfile for that group. If it finds the group, it will begin blinking each object in the group. Hit [RETURN] key to stop the blinking and return to the GROUP menu.

3.5.12 LIST

The LIST option allows you to list out all of the groups by name that are a part of your current drawing. This is very useful when you cannot remember the name of a group you wish to move, copy or scale.

3.5.13 GROUP PROPERTIES

Refer to section 3.6 in this manual for a description of the GROUP PROPERTIES option.

3.5.14 FIND

The FIND option allows you to quickly select the group that is to be modified. This option frees you from having to memorize group names.

When this option is selected, the program will ask that you pick an object in the group you want to modify. Select the desired group by moving the cursor to any point on the object. Once the cursor is on the object, accept it by pressing the cursor button. The program will then search through the drawing looking for the object. It can take a few seconds for the program to find the object, especially if the drawing has many objects. When it has found the object, it will set the default group name to the selected object's group name.

It is important to note that when you place the cursor near the desired object, try not to place it near any other objects as well. It will be easier for the program to find the object.

Once the program has found the object, you will not need to enter a group name until you want to modify a different group or you leave the GROUP menu. The FIND option can save you a great deal of time if you use groups frequently.

3.5.15 SKETCH

Refer to section 3.19 in this manual for a description of the SKETCH option.

3.5.16 QUIT

The QUIT option allows you to exit the GROUP menu and return to the 2D program MAIN MENU.

3.6 GROUP PROPERTIES

3.6.1 FUNCTION SELECTION

The GROUP PROPERTIES menu can be reached by choosing the 'P' character on the GROUP menu.

The GROUP PROPERTIES looks like this:

```
GROUP PROPERTIES:
                    PROPOSED
 [S] lineStyle:
 [D] Density:
 [L] Level:
 [P] Pen:
 [N] group Name:
 [W] Width:
 [H] Height:
 [A] Arrow:
 [T] Template:
 [M] Marker:

 [G] Global properties
 [C] Clear proposed
 [U] Update properties
 [Q] Quit
 [?] help
```

3.6.2 PURPOSE

The GROUP PROPERTIES option allows you to change the properties of all the objects in a group.

A property can be thought of as an attribute or characteristic of an object. All primitive objects have several properties. For example, two properties of a line are: a group name of 'N1' and a plotter linestyle of 3.

Using the GROUP PROPERTIES option you can selectively change one or more properties of all the objects in a group. For example, you can change the plotter pen number of all objects in a group from 2 to 3.

The basic idea behind the GROUP PROPERTIES option is that you change a group's properties by creating a list of proposed changes. The current properties of all the objects in the group are then changed to the proposed properties all at once.

3.6.3 DATA ENTRY

Like many options on the GROUPS menu, the GROUP PROPERTIES option requires the entry of a group name. This is necessary in order for the program to know which group's properties are to be modified. Type in the name (7 characters maximum) of the group whose properties you wish to change. If you wish to use the default group name shown, then hit only the [RETURN] key in response.

The program will respond by printing a list of all the properties available for change. The list contains one column, the 'PROPOSED' column, which contains the new proposed properties. Initially, the 'PROPOSED' column is blank. An example is shown below:

```
                    PROPOSED
[S] lineStyle:
[D] Density:
[L] Level:
[P] Pen:
[N] group Name:
[W] Width:
[H] Height:
[A] Arrow:
[T] Template:
[M] Marker:
```

When an option in the GROUP PROPERTIES menu is selected, the program positions you to enter the new proposed value of that property. After you have entered the new value it will be displayed in the 'PROPOSED' column. In the example below, new values have been proposed for both the plotter linestyle and the plotter pen number. The proposed value for the linestyle is 3 and the proposed value for the pen is 2.

```
                    PROPOSED
[S] lineStyle:      3
[D] Density:
[L] Level:
[P] Pen:            2
[N] group Name:
[W] Width:
[H] Height:
[A] Arrow:
[T] Template:
[M] Marker:
```

It is important to remember that the proposed values are just that, proposed. The current values of the objects in the group are not changed to the proposed values until the UPDATE PROPERTIES option is selected. When the UPDATE PROPERTIES option is selected, all objects in the group will have their properties changed to the 'PROPOSED' values. Properties with no 'PROPOSED' changes will not be changed. In the example above, all objects in the group will have their plotter linestyles changed to 3, and their plotter pen numbers changed to 2.

3.6.4 LINESTYLE

The LINESTYLE option allows you to change the linestyle property of all of the objects in a group.

For example, if you want to change the linestyle of all objects in group NEW from linestyle number 1 to number 3, you should select the LINESTYLE option from the GROUP PROPERTIES menu and type in a 3. This option is only meaningful for those plotters that support different linestyles. It is suggested that you experiment with the various linestyles to determine the most appropriate one to use.

When you select this option the program will ask you to enter the new linestyle. Enter the desired linestyle number and then hit the [RETURN] key. Hitting [RETURN] without entering a new number will keep the old linestyle. The new linestyle value will be displayed in the 'PROPOSED' column. When the proposed property changes are made permanent, the program will draw the group using the new linestyle.

3.6.5 DENSITY

The DENSITY option allows you to change the number of times the plotter will overstrike each object in a group.

For example, suppose that you want all objects in the group 'GRP' to be drawn with very dark lines. You should select the DENSITY option on the GROUP PROPERTIES menu and type in a number like 3 or 4 as the density value of that group.

When you select this option, the program will ask you to enter the new density value. Enter the desired number then hit the [RETURN] key. Hitting [RETURN] without entering a new density value will keep the old value. The new density value will be displayed in the 'PROPOSED' column.

3.6.6 LEVEL

The LEVEL option allows you to change the level property of all of the objects in a group.

For example, all objects in a group 'ONE' could have their levels changed from level 3 to level 5 by using the LEVEL option.

When you select this option the program will ask you to enter the new level number. Enter the new number and hit the [RETURN] key. Hitting [RETURN] without entering a new number will keep the old level number. The new level number will be displayed in the 'PROPOSED' column.

3.6.7 PEN

The PEN option allows you to change the plotter pen property of all of the objects in a group.

For example, you can change the pen number of all objects in a group from pen number 3 to pen number 2. This option is only meaningful for those plotters that support multiple pens.

When you select this option the program will ask you to enter the new pen number. Enter the new number and hit the [RETURN] key. Hitting [RETURN] without entering a new number will keep the old pen number. The new pen number will be displayed in the 'PROPOSED' column.

3.6.8 GROUP NAME

The GROUP NAME option allows you to change the name of all of the objects in a group.

For example, the GROUP NAME option could be used to change the name of the group 'ONE' to 'TWO'.

When you select this option the program will ask you to enter the new group name. Enter the new name (7 character maximum) and hit the [RETURN] key. Hitting [RETURN] without entering a new name will keep the old group name. The new name will be displayed in the 'PROPOSED' column.

3.6.9 WIDTH

The WIDTH option allows you to change the character width of all of the text objects in a group.

The character text width defines how wide a single character is. The width is always in terms of real world coordinates. For example, if your drawing ranges from 0 - 10 feet in the X direction and 0 - 8 feet in the Y direction, a character text width of 1 will cause each character's width to be 1 foot.

When you select this option the program will ask you to enter the new text width. Enter the desired number (which can be a real number) and hit the [RETURN] key. Hitting [RETURN] without entering a new number will keep the old text width. The new value will be displayed in the 'PROPOSED' column.

3.6.10 HEIGHT

The HEIGHT option allows you to change the character height of all of the text objects in a group.

The character text height defines how high a single character is. The height is always in terms of real world coordinates. For example, if your drawing ranges from 0 - 10 feet in the X direction and 0 - 8 feet in the Y direction, a character text height of 1 will cause each character's height to be 1 foot.

When you select this option the program will ask you to enter the new text height. Enter the desired number (which can be a real number) and hit the [RETURN] key. Hitting [RETURN] without entering a new number will keep the old text height. The new value will be displayed in the 'PROPOSED' column.

3.6.11 ARROW

The ARROW option allows you to add or remove the arrowheads from all of the objects in a group.

For example, if you want to remove all arrowheads from all objects in a group 'GRP', you should use this option. This option is meaningful only for those objects that allow arrowheads, such as lines and bezier curves.

When you select this option the program will position you to enter either a 'Y' or an 'N'. Type in the desired value. Typing any keys other than 'Y' or 'N' will cause the program to keep the old value. The new value will be displayed in the 'PROPOSED' column.

3.6.12 TEMPLATE

The TEMPLATE option allows you to make all of the objects in a group into template objects or from template objects to normal objects.

For example, if you want a particular group to become a template group, select the TEMPLATE option and type 'Y'.

When you select this option the program will position you to enter either a 'Y' or an 'N'. Type in the desired value. Typing any keys other than 'Y' or 'N' will cause the program to keep the old value. The new value will be displayed in the 'PROPOSED' column.

3.6.13 MARKER

The MARKER option allows you to tell the program to show the center marker of all of the objects in a group.

When you select this option, the porgram will position you to enter either a 'Y' or an 'N'. Press the desired key. Pressing any keys other than 'Y' or 'N' will cause the program to keep the old value. The new value will be displayed in the 'PROPOSED' column.

3.6.14 GLOBAL PROPERTIES

The GLOBAL PROPERTIES option allows you to setup a 'PROPOSED' column containing all the global property values.

When you select this option the program will display in the 'PROPOSED' column all of the global properties that are defined on the PROPERTIES menu located off the MAIN MENU. The current properties of the objects in the group will NOT be changed to the proposed properties until the UPDATE PROPERTIES option is selected.

3.6.15 CLEAR PROPOSED

The CLEAR PROPOSED option clears the 'PROPOSED' column to contain no changes.

You should select this option anytime you want to clear the 'PROPOSED' column. For example, you might want to do this if you made a mistake and changed several of the wrong properties.

3.6.16 UPDATE PROPERTIES

The UPDATE PROPERTIES option actually sets and makes permanent all the changes listed in the 'PROPOSED' column.

As an example, suppose you have the following displayed on your screen:

```
                    PROPOSED
[S] lineStyle:          3
[D] Density:
[L] Level:
[P] Pen:                2
[N] group Name:
[W] Width:
[H] Height:
[A] Arrow:
[T] Template
[M] Marker:
```

Selecting UPDATE PROPERTIES at this time will change the linestyle of all objects in the group to 3 and the pen numbers to 2. All other properties of the objects will remain unchanged.

3.6.17 QUIT

The QUIT option exits the GROUP PROPERTIES menu and returns you to the GROUP menu.

3.7 FILER

3.7.1 FUNCTION SELECTION

The FILER menu can be reached by choosing the 'F' key on the 2D program MAIN MENU. FILER options can be used at any time during the creation of a drawing.

The FILER menu looks like this:

```
FILER:
 [G] Get
 [S] Save
 [M] Merge
 [F] save Fotofile
 [D] Delete
 [L] List
 [C] Crunch
 [N] New
 [R] dRive
 [W] What
 [K] sKetch
 [Q] Quit
 [?] Help
```

3.7.2 PURPOSE

All drawings that you create or modify must be permanently saved on a disk for filing purposes. The disk on which your drawings are saved is called a drawing file disk. The FILER menu provides a SAVE option that can transfer the drawing that is in the workfile to a desired drawing file disk. Also, it provides a GET option that can retrieve a drawing from a drawing file disk and store it in the workfile. Composite drawings can be created by retrieving more than one drawing from your drawing file disks by succesively using the MERGE option.

When you purchased your CADAPPLE system, you were provided with four (4) disks. One of which was a disk labeled 'WORK' diskette. This diskette contains the 2D workfile and some additional space. As explained in section 2.25, the workfile is actually a copy of the drawing being changed.

Saving and retrieving a drawing is done to and from a drawing file disk. This disk must be prepared for use by following the instructions in the CADAPPLE installation manual. You can create as many drawing file disks as you need to archive your drawings. The following procedure outlines how to use your drawing file disks:

1. Select the FILER option on the MAIN MENU.
2. Select the WHAT option on the FILER menu.
3. If the default drive is set to #5 then go to step #6.
4. Select the DRIVE option from the FILER.
5. Change the default drive to be #5.
6. Select the appropriate FILER option (SAVE, GET, LIST etc.).
7. Remove the 'CODE' disk from drive #5.
8. Place the drawing file disk in drive #5.
9. Hit the [RETURN] key to tell the program that the data disk is in drive #5.
10. Answer all questions regarding the FILER option selected.
11. Replace the 'CODE' disk in drive #5 when finished with option.

It is recommended that a drawing be saved several times on its appropriate drawing file disk during its creation. This provides a backup in case the designer errs while changing the drawing. At times, it is much easier to work on a backup of the drawing, instead of trying to 'undo' any previous mistakes.

3.7.3 GET

The GET option allows you to transfer a previously saved drawing from your drawing file disk to your workfile. The workfile WILL be cleared of all information before the transfer is made.

If there is information in the workfile when this option is selected, the program will display the following warning message:

> WARNING: This option will clear all of the information in the workfile. Proceed with Get (Y/N) ?

The GET option will not allow you to merge files. This feature was built into the program in order to prevent you from duplicating information in your workfile. If you want to abort and leave this option, press the 'N' key. If you press the 'Y' key, the program will display the following message:

> Place datafile disk into volume #5
> Press [RETURN] to continue

The program is now waiting for you to swap disks if necessary. For example, you may have to remove the 'CODE' disk and insert a data disk in its place. Once you have swapped disks and pressed the [RETURN] key, the program will display the following message:

> Get what drawing ?

Enter the name (up to 8 characters in length) of the drawing that you wish to retrieve and press the [RETURN] key. If you do not wish to get a drawing or you do not wish to lose all of the information in your workfile, then press the [ESC] key.

If the program finds the drawing on the disk, it will load all of its information into the workfile. The program will display this information on the screen using the units, switches and properties from this drawing.

When the drawing has been read in from the disk, the program will display a message confirming that everything went ok.

3.7.4 SAVE

The SAVE option allows you to save your current workfile on the diskette in the default data drive. When this option is selected, the program will respond with:

```
Place datafile disk into volume #5
Hit [RETURN] to continue.
```

The program is now waiting for you to swap disks if necessary. For example, you may have to remove the 'CODE' disk and insert a data disk. When you are ready to continue, type the [RETURN] key. The program will then ask:

```
Save as what drawing ?
```

Enter the name (up to 8 characters in length) that you wish to call the file and hit the [RETURN] key. Once the name has been entered, the program will display a message informing you that the file has been saved.

If your drawing file diskette is full and the workfile cannot be saved, the following message will be displayed:

```
Cannot save drawing.
```

This problem may be solved in a couple of ways:

- The first solution requires that you use a different drawing file data disk that has enough room to store your drawing. You may have stored the maximum amount of drawing files possible on the full drawing file disk.

- The second solution requires that you exit the 2D program and use the Remove option of the Pascal operating system FILER menu to remove all unwanted files on the full drawing file data disk. Once the unwanted files have been removed, the Krunch option on this menu should be used to collect all unused areas on the drawing file disk.

If you select the second method above and therefore must exit the 2D program, be assured that the workfile will remain intact until you return to the 2D program. Simply recover the workfile when you return to the 2D program.

3.7.5 MERGE

The MERGE option allows you to transfer a previously saved drawing from your drawing file disk to your workfile. The workfile will NOT be cleared of all information before the transfer is made.

The MERGE option will allow you to merge files. This allows you to create a composite drawing from its parts. When this option is selected, the program will display the following message:

```
Place datafile disk into volume #5
Press [RETURN] to continue
```

The program is now waiting for you to swap disks if necessary. For example, you may have to remove the 'CODE' disk and insert a data disk in its place. Once you have swapped disks and pressed the [RETURN] key, the following message will be displayed:

```
Merge what drawing ?
```

Enter the name (up to 8 characters length) of the drawing that you wish to retrieve and press the [RETURN] key. If you do not wish to merge a drawing, press the [ESC] key. If the program finds the drawing on the disk, the following message will be displayed:

```
Use the switches, units, properties, windows, and
plot specs from this new drawing (Y/N) ?
```

If you press the 'Y' key, then the program will set the current switches, units, properties, windows and plot specs to those of the new drawing and merge the objects of the new drawing with that of the workfile. If you press the 'N' key, then the program will only merge the objects of the new drawing.

This is a very powerful option since it allows you to create 'empty' drawings with special defined switches, units, properties, windows and plot specs. These 'empty' drawings can be used later to quickly setup a working environment. As an example, you might have created and saved a drawing called 'TITLE' which has special environment parameters pre-defined (and maybe even a title block). When you need a title block along with the necessary plot specs, you could MERGE this drawing with your present drawing. Thus, you could create your drawing without the overhead of the title block information until you needed it for plotting.

After answering the question concerning the environment parameters, the program will display the following message:

```
Put objects of the drawing into the
group (default group) (Y/N) ?
```

Where (default group) is the name of the current default group name defined on the PROPERTIES menu. If you press the 'Y' key, then the program will change the group name of each object of the new drawing to that of the (default group). This allows you to merge all of the objects of the new drawing into one group for future manipulation.

When the drawing has been read in from the disk, the program will display a message confirming that everything went ok.

3.7.6 SAVE FOTOFILE

The SAVE FOTOFILE option allows you to save your current screen image as a 'foto file'. When this option is selected, the program will respond with:

```
Place datafile disk into volume #5
Hit [RETURN] to continue.
```

The program is now waiting for you to swap disks if necessary. For example, you may have to remove the 'CODE' disk and insert a data disk. When you are ready to continue, type the [RETURN] key. The program will then ask:

```
Save as what foto drawing ?
```

Enter the name (up to 8 characters in length) that you wish to call the file, and hit the [RETURN] key. Once the name has been entered, the program will display a message informing you that the file has been saved. If the workfile cannot be saved, an appropriate message will be displayed.

A foto file is a special type of file that can be used by other programs, but NOT by the 2D drafting program. There is no compatibility with the 2D program because the foto files have no information associated with them except a dot pattern.

How do you use foto file? Basically, a foto file is nothing but a picture of the screen at a particular instant in time. These fotos can be used in a 'cycle' presentation much like a slide show. For example, an animation sequence can be produced using the 2D program to draw the picture frames, and save them as foto files. Once the fotos are created, the cycle program, sold by T & W SYSTEMS, displays them in the desired sequence.

3.7.7 DELETE

The DELETE option allows you to delete any 2D drawing that you have saved on the diskette in the default data drive. When this option is selected, the program will respond with:

```
Place datafile disk into volume #5
Hit [RETURN] to continue.
```

The program is now waiting for you to swap disks if necessary. For example, you may have to remove the 'CODE' disk and insert a data disk. When you are ready to continue, type the [RETURN] key. The program will then ask:

```
Delete what drawing ?
```

Enter the name (up to 8 characters in length) of the drawing that is to be deleted, and hit the [RETURN] key. Once the name has been entered, the program will display a message informing you that the file has been deleted. If the graphics file does not exist, an appropriate message will be displayed.

3.7.8 LIST

The LIST option allows you to list all of the 2D graphics files that have been saved on the diskette in the default data drive. When this option is selected, the program will respond with:

```
Place datafile disk into volume #5
Hit [RETURN] to continue.
```

The program is now waiting for you to swap disks if necessary. For example, you may have to remove the 'CODE' disk and insert a data disk. When you are ready to continue, type the [RETURN] key.

The program will respond by listing all the 2D files stored on the diskette in the default data drive. This option is quite helpful when you cannot remember the name of a particular graphics file that you want to GET or DELETE.

3.7.9 CRUNCH

The CRUNCH option allows you to 'crunch' your workfile.

The process of adding and deleting objects from your drawing can leave empty (and unusable) 'holes' in your workfile. CRUNCHing the workfile will remove any of these holes.

This option should be used only when you get the following message, 'No more room, resize workfile'. Crunching the workfile may create the needed room.

Use this option only after careful thought. After you have crunched your workfile, the possibility of UNDELETING any objects, text or groups that you have previously deleted is gone. For you protection, a warning message is provided to prevent you from accidentally crunching the workfile.

If crunching the workfile does not create the needed room, you must resize your workfile, your drawing has become too large. This can be done by running the ENVIRO program. See the ENVIRO User's manual for details on how to change the workfile size.

3.7.10 NEW

The NEW option allows you to initialize your workfile.

When selected, this option will erase everything saved in your workfile, and will clear the graphics screen. All objects, saved windows, and plotter specs are erased. Generally this option is used whenever you are going to be working on a new drawing. If you want to SAVE the drawing presently in your workfile, you should do so before selecting this option. Caution and careful thought should be used before selecting this option. Once everything has been erased, nothing can be recovered through the UNDELETE options.

For your protection, a warning message is displayed informing you of the potential dangers involved. If you wish to continue, answer with a 'Y'. Otherwise, answer with a 'N'.

3.7.11 DRIVE

The DRIVE option allows you to override the default data drive number specified in the ENVIRO program. When the DRIVE option is selected, the program will respond with:

Enter new default data drive # ?

Enter one of the appropriate drive numbers: 4, 5, 9, 10, 11, 12. For example, if the drive number was set to #5 in the ENVIRO program and you need to GET a drawing from drive #9, then simply change the drive number to #9 using this option. This change will remain as long as you are running the program. The next time you run the program, the drive number will return to the value specified in the ENVIRO program.

3.7.12 WHAT

The WHAT option displays useful information about the status of the current workfile.

When this option is selected, the program will display the maximum amount of space available for objects, the amount of space already used and the default data drive number. An example of a typical display would be:

```
Object storage available:  1003
Object storage used:  55
Default data drive is #5
```

Your workfile is a fixed size. The WHAT option will tell you the available workfile storage and the amount of workfile storage that your current drawing has already used. The storage units are related to object 'records'. You can think of a record as an object or a text item (some long texts require two records of storage). So, if your drawing consists of only 6 lines, the WHAT option will tell you that you have used 6 records.

The program will eventually tell you when the workfile is full. If the workfile does become full, then you should use the CRUNCH option off the FILER menu to make more room.

The 2D program will always SAVE, GET or LIST drawings from the default data drive. The default data drive number is changed whenever the DRIVE option is used.

Note: The WHAT option does not give any information about how 'full' a particular diskette may be. Rather, the WHAT option provides information about the space available in the current workfile.

3.7.13 SKETCH

Refer to section 3.19 of this manual for a description of the SKETCH option.

3.7.14 QUIT

The QUIT option allows you to exit the FILER menu and return to the 2D program MAIN MENU.

3.8 UNITS

3.8.1 FUNCTION SELECTION

The UNITS option is reached by choosing the 'U' key from the 2D program MAIN MENU.

The UNITS option looks like this:

```
UNITS:
  [S] Set origin
  [C] Clear origin
  [D] Display origin
  [R] Rotation:
  [I] Increment
  [F] library Factor:
  [B] Base window
    left:              right:
    bottom:            top:
  [G] Grids
    x space:           divs:
    y space:           divs:
  [K] sKetch
  [Q] Quit
  [?] Help
```

3.8.2 PURPOSE

The UNITS option allows you to examine and/or change the various default parameters that are used throughout the program.

When a drawing is started, several parameters must be defined. These parameters include the drawing size, the grid definition, the size of the smallest increment and the origin shift. These parameters must be defined before any work is begun.

3.8.3 DATA ENTRY

When you select the UNITS option the program will display the current working parameters. An example screen is shown below:

```
  [S] Set origin
  [C] Clear origin
  [D] Display origin
  [R] Rotation:        90.0000
  [I] Increment:       1.0000
  [F] library Factor: 1.0000
  [B] Base window
    left:     0.0000     right:    279.0000
    bottom:   0.0000     top:      191.0000
  [G] Grids
    x space:             divs:
    y space:             divs:
  [K] sKetch
  [Q] Quit
  [?] Help
```

When an option on the UNITS menu is chosen, the program will position you to change the value of that parameter. Since you will be entering a numeric value, you will be required to type the [RETURN] key to terminate your entry. The new value will then be displayed on the screen. Type only the [RETURN] key if you want to use the displayed parameter. Type only the [ESC] key to abort your entry altogether.

Typically, a drawng is created in a system of units, such as feet, inches or centimeters. However, the 2D program does not use any specific system of units. Rather, the program requires that you annotate your drawing so that it is understood that all units are in feet, inches or centimeters. The program does not regard any of the working parameters on the UNITS menu to belong to any system of units. Rather, the program requires that you remember that you are working in feet, inches or centimeters.

3.8.4 SET ORIGIN

The SET ORIGIN option allows you to shift the base window's origin.

When this option is selected, the program will display the following message:

> Place cursor and press button to enter the origin's shift.

At this time, move your cursor to the position on the screen that you want to be the new origin. Accept this position by pressing the cursor button. If you do not want to change the origin, then simply press the [ESC] key and the program will abort this option.

If the origin was successfully changed, then the program will display '0' near the coordinate dial in the lower right hand corner of the text screen and display the following message verifying that the origin has been changed:

> The origin's position is:
> X: x.xxxx Y: y.yyyy

If the origin is shifted, then all digitizer, joystick and keyboard coordinates will be converted to the shifted system.

3.8.5 CLEAR ORIGIN

The CLEAR ORIGIN option allows you to reset the shift of the base window's origin to 0,0.

When this option is selected, the program will display '.' near the coordinate dial in the lower right hand corner of the text screen and display the following message verifying that the origin has been reset:

```
The origin's position is:
X:  0.0000          Y:  0.0000
```

3.8.6 DISPLAY ORIGIN

The DISPLAY ORIGIN option allows you to display the current shift of the base window's origin.

When this option is selected, the program will display the following message:

```
The origin's position is:
X:  x.xxxx          Y:  y.yyyy
```

3.8.7 ROTATION

The ROTATION option allows you to change the global default value of the incremental rotation.

When this option is selected, the program will position you to enter the new value of the incremental rotation. Enter the desired rotation (0 through 360 degrees) and press the [RETURN] key. The new incremental rotation will be displayed. Pressing the [RETURN] key without entering a value will keep the old incremental rotation.

The incremental rotation defines a specific amount of degrees that will be used in an operation allowing rotation. For example, let us say that the ROTATION option was defined as 45 degrees. An option that allows rotation is the TEXT option off the ADD menu. Once the text has been entered, the program allows you to place the text on the drawing. Before accepting the text's position, you may select the text ROTATION option. This will cause the text to be rotated by 45 degrees. Thus the text can be displayed at the following angles: 0,45,90,135,180,225,270, and 315 degrees.

3.8.8 LIBRARY FACTOR

The LIBRARY FACTOR option allows you to change the global default value of the library scaling factor.

When this option is selected, the program will position you to enter the new value of the library scaling factor. Enter the desired scaling factor (must be greater than 1.0) and press the [RETURN] key. The new library scaling factor will be displayed. Pressing [RETURN] without entering a value will keep the old library scaling factor.

The library scaling factor is used when you are placing groups on your drawing from a library. This option is especially useful if you want to scale all of the groups in a library by a constant amount. For example, let us say that all of the groups within a library were defined in feet. Later, you may need the groups within the library defined in meters. Simply change the library scaling factor to 0.3048 (feet to meters conversion factor) and the groups within the library will be automatically scaled to meters when placed on the drawing.

3.8.9 INCREMENT

The INCREMENT option allows you to change the global default value of the smallest increment.

The smallest increment defines the smallest incremental unit of precision that the program must maintain. It is primarily used with increment snap function as an aid in the precise placement of objects. The initial value of the smallest increment is 1.0.

When you select this option the program will position you to enter the new value of the smallest increment. Enter the desired number and hit the [RETURN] key to terminate your entry. The new smallest increment will be displayed. Pressing [RETURN] without entering a number will keep the old increment value.

When the increment snap function is on, the program will automatically round the cursor to a multiple of the smallest increment. The smallest increment can be changed at any time while creating a drawing allowing a higher degree of resolution. When using increment snap, the cursor and coordinate dial may not always reflect every multiple of the smallest increment. If this is the case, then the use of the WINDOW function should produce a finer resolution. Thus allowing more precise placement of the cursor.

3.8.10 BASE WINDOW

The BASE WINDOW option allows you to change the base window that will be used for the current drawing.

The base window is an arbitrary, user definable, screen coordinate system that is meant to be used as the definition of the drawing size. The initial value of the base window is:

left:	0.0000	right:	279.0000
bottom:	0.0000	top:	191.0000

What is the 'best' base window is a matter of user preference. For example, if you are drawing a floor plan that is 40 feet by 30 feet, you might want to set your base window to:

left:	0.0000	right:	60.0000
bottom:	0.0000	top:	45.0000

When you select this option, the program will ask you to enter the real world absolute coordinates of the left, right and bottom edges of the screen. The program will not allow you to enter the fourth edge of the screen because it is calculated automatically to preserve the correct window proportions.

As the program positions you to enter each new value simply type in the desired decimal number, followed by the [RETURN] key. Type only the [RETURN] key to keep the current value displayed and position you for the next value.

Once all of the parameters have been entered, the program will redraw the screen using the new base window. Also, the program will automatically erase the current GRID system to avoid the problem of the grids becoming too small or too big.

In general, you should not be changing the base window while you are creating a drawing. The base window should be carefully planned and changed only when you are beginning a drawing.

3.8.11 GRIDS

The GRIDS option allows you to place an X-Y grid on the screen. The grid system aids in the precise alignment of graphics objects. Both X-axis and Y-axis grid lines must be specified.

When you select this option the program will position you to enter the X-axis spacing. This spacing is defined in terms of real world coordinates and represents the perpendicular distance between the vertical grid lines. Enter a decimal number and type the [RETURN] key.

The program will then position you to enter the number of divisions. The divisions field defines the number of units to be marked off between the grid intersections. For example, if the X-axis spacing entered is 10.0 and the grid divisions entered is 10 then the program will mark off 10 equal units between the grid intersections by plotting a dot every 1/10th of a grid spacing.

Once the X-axis grid lines have been entered you will be positioned to enter the Y-axis grid lines. Enter the appropriate values as described for the X-axis grid lines. If the Y-axis grid line values are identical to the X-axis grid line values, then simply type the [RETURN] key at the Y-axis spacing field. The program will duplicate the X-axis spacing and division values. After you have finished defining the grid system, the program will display the new grids.

There will always be a dot plotted for each grid intersection. If the distance between the grid intersections becomes too small, then the program will not display the grid line's divisions.

A simple way to remove the grid system is to select the GRIDS option and just type the [RETURN] key when defining the X-axis spacing. This will erase the old grids and since you haven't defined any new ones, no new grids will be displayed. Grids can be temporarily turned off by using the GRIDS option on the SWITCHES menu.

3.8.12 SKETCH

Refer to section 3.19 of this manual for a description of the SKETCH option.

3.8.13 QUIT

The QUIT option exits the UNITS menu and returns you to the 2D MAIN MENU.

3.9 PROPERTIES

3.9.1 FUNCTION SELECTION

The PROPERTIES option is reached by choosing the 'P' key from the 2D program MAIN MENU.

The PROPERTIES option looks like this:

```
PROPERTIES:

 [S] lineStyle:
 [D] Density:
 [L] Level:
 [P] Pen:
 [N] group Name:
 [T] Text
   width:              height:
 [Q] Quit
 [?] Help
```

3.9.2 PURPOSE

The PROPERTIES option allows you to examine and/or change the various initial properties that are used throughout the program.

When an object is created, such as a line, it is given several initial properties (or attributes) that determine what it will look like and when it will be drawn. Examples of a property are the standard size of a text character, the object's linestyle and the group name.

It is important to note that if an object is to be assigned certain property values, then these properties must be changed before the object is created. For example, if you want to add a line on the drawing with a plotter pen property of '4', then before you draw the line you must change the PEN option on the PROPERTIES menu to '4'.

3.9.3 DATA ENTRY

When you select the PROPERTIES option the program will list all of the available properties, along with their current values, on the left hand side of the screen. An example is shown below:

```
[S] lineStyle:    1
[D] Density:      1
[L] Level:        1
[P] Pen:          1
[N] group Name:   GRP
[T] Text
  width:    5.0000          height:  7.0000
[Q] Quit
[?] Help
```

When a PROPERTIES option is chosen, the program will position you to change the current value of that property. Depending on the particular property, either numbers or characters are 'ok' to enter. Enter the new value and type the [RETURN] key to terminate your entry. Type only the [RETURN] to enter the value displayed. The new property will then be displayed on the screen. Type the [ESC] key to abort the option with no change to the property.

3.9.4 LINESTYLE

The LINESTYLE option allows you to change the linestyle property.

A linestyle is a repetitive line pattern that is produced on the screen as well as on the plotter. The 'normal' linestyle is a solid line. Other linestyles include dotted, dashed, and dotted-dashed lines. The initial value of the plotter linestyle property is 1.

When you select this option the program ask you to enter the new linestyle value. Enter the desired number and hit the [RETURN] key. Hitting [RETURN] without entering a number will keep the old linestyle number. The new default linestyle value will be displayed on the screen.

The option is only meaningful for those plotters that support different linestyles. It is suggested that you experiment with the various linestyles to determine the most appropriate one to use. Also, you may want to refer to the APPENDIX of this manual for a list of linestyles available for your plotter.

3.9.5 DENSITY

The DENSITY option allows you to change the 'density' property.

The density is the number of times that the plotter will overstrike each object. This feature is useful for making selected objects darker. The initial value of the density property is 1.

When you select this option the program will ask you to enter the new density value. Enter the desired number and hit the [RETURN] key. Hitting [RETURN] without entering a number will keep the old density value. The new density value will be displayed on the screen.

3.9.6 LEVEL

The LEVEL option allows you to change the level property.

A level can be thought of as one sheet of a clear plastic overlay. All objects with the same level number are on the same plastic sheet. Turning on one level is like viewing only one sheet. Turning on a second level is like placing a second sheet on top of the first - you can now see the objects on both sheets (or levels). Turning off a level is like removing the corresponding plastic sheet.

Levels are the most useful if relatied objects are grouped together in a common level. For example, if you are doing a floor plan, you might want to put the basic floor plan on level #1, all chairs on level #2, all fixtures on level #3, and so on. Then you could work with any combination of the items at any time.

The 2D program allows you to use up to 250 different levels. The levels are numbered 1 through 250. Any combination of these levels can be used at any time. The initial value of the default level number is 1.

When you select this option the program will ask you to enter the new level value. Enter the desired number and hit the [RETURN] key. Hitting the [RETURN] without entering a number will keep the old level number. The new level number will be displayed on the screen.

3.9.7 PEN

The PEN option allows you to change the plotter pen property.

Many plotters have more than one pen available at a time. These pens may be of different colors or weights. The pen numbers correspond to the pen stalls of the plotter. For example, a pen number of 1 will cause the plotter to use the pen that it is in stall number 1. This option is only meaningful for those plotters that support multiple pens. The initial value of the default plotter pen number is 1.

When you select this option the program will ask you to enter the new pen number. Enter the desired number and hit the [RETURN] key. Hitting the [RETURN] without entering a number will keep the old pen number. The new pen number will be displayed on the screen.

3.9.8 GROUP NAME

The GROUP NAME option allows you to change the group name property.

As objects are created, they are put into the group defined by the group name property. Changing this name changes the group that objects will be put into as they are created. Any group function will operate on all objects with the same group name. The initial value of the default group name is 'GRP'.

When you select this option the program will ask you to enter the new group name (7 characters maximum). Enter the desired name and hit the [RETURN] key. Hitting the [RETURN] without entering a new name will keep the old group name. The new group name will be displayed on the screen.

3.9.9 TEXT

The TEXT option allows you to change the text properties that determine how text characters will be displayed when first created.

The values that can be changed are text width and text height. The text width and height define the width and height of a single text character. They are both in terms of real world coordinates. The initial value of the default text width is 5.0, text height is 7.0.

When you select this option the program will position you to enter the new width property, and then the new height property. In each case, enter the desired number and hit the [RETURN] key. Hitting the [RETURN] key without entering a new number will keep the old value. The new values will be displayed on the screen.

3.9.10 QUIT

The QUIT option exits the PROPERTIES menu and returns you to the 2D MAIN MENU.

3.10 SWITCHES

3.10.1 FUNCTION SELECTION

The SWITCHES option can be reached by choosing the 'S' key from the 2D program MAIN MENU.

The SWITCHES option looks like this:

```
SWITCHES:
                        CURRENT
 [M] Marker:
 [T] Template:
 [G] Grids:
 [W] Words:
 [H] Hatch:
 [D] Debug:
 [A] All levels:
 [L] Levels
 [K] sKetch
 [Q] Quit
 [?] help
```

3.10.2 PURPOSE

The SWITCHES option allows you to examine and/or change the various 'switches' that are used throughout the 2D program.

These switches control whether a particular function is turned 'on' or 'off'.

An example of a switch used by the program is the 'show center marker' switch. This switch controls whether or not a small marker will be drawn at an object's handle(s).

3.10.3 DATA ENTRY

When you select the SWITCHES option the program will list all of the available switches, along with their current values, on the left hand side of the screen. An example is shown below:

```
                CURRENT
[M] Marker:       Yes
[T] Template:     Yes
[G] Grids:        Yes
[W] Words:        Yes
[H] Hatch:        Yes
[D] Debug:        No
[A] All levels:   Yes
[L] Levels
[K] sKetch
[Q] Quit
[?] Help
```

When a SWITCHES option is chosen, the program will position you to change the current value of that switch. The only legal values of a switch are 'Y' (for Yes) and 'N' (for No). Type in the new switch value, or hit any illegal character for no change. The new value will then be displayed on the screen.

3.10.4 MARKER

The MARKER option allows you to change the global show center marker switch.

If the center marker switch is set to 'Yes' then all objects that have their marker property turned on will be drawn with a marker at their centers. If the switch is set to 'No' then the markers will not be shown. The initial value of the show marker switch is 'Y'.

When you select this option the program will position you to enter either a 'Y' (for Yes) or an 'N' (for No). Type in the desired letter. Typing any keys other than 'Y' or 'N' will cause the program to keep the old switch value.

3.10.5 TEMPLATE

The TEMPLATE option allows you to change the global show template switch.

If the show template switch is set to 'Yes' then all template objects will be drawn whenever the screen is redrawn. If the switch is set to 'No' then template objects will not be shown. The initial value of the show template switch is 'Y'.

When you select this option the program will position you to enter either a 'Y' (for Yes) or an 'N' (for No). Type in the desired letter. Typing any keys other than 'Y' or 'N' will cause the program to keep the old switch value.

3.10.6 GRIDS

The GRIDS option allows you to change the global show grids switch.

If the show grids switch is set to 'Yes' then whenever the screen is redrawn the currently defined grid lines will be shown. If the switch is set to 'No' then the grid lines will not be shown, even if they are currently defined in the UNITS menu. The initial value of the show grids switch to 'Y'.

This option is a convenient way to turn grids on and off without having to redefine them each time.

When you select this option the program will position you to enter either a 'Y' (for Yes) or an 'N' (for No). Type in the desired letter. Typing any keys other than 'Y' or 'N' will cause the program to keep the old switch value.

3.10.7 WORDS

The WORDS option allows you to change the global show words (or text) switch.

If the show words switch is set to 'Yes' then all text will be drawn as actual text. However, if the switch is set to 'No' then each text object will be drawn as two parallel lines to indicate the text's location. The initial value of the show words switch is 'Y'.

The advantage to showing only parallel lines is that the drawing can be redrawn much faster. Also, if it is not necessary to view the text, the screen looks much less cluttered with parallel lines instead of text.

When you select this option the program will position you to enter either a 'Y' (for Yes) or an 'N' (for No). Type in the desired letter. Typing any keys other than 'Y' or 'N' will cause the program to keep the old switch value.

3.10.8 HATCH

The HATCH option allows you to change the global show hatch switch.

If the show hatch switch is set to 'Yes', then whenever the screen is redrawn the program will attempt to draw any hatch lines. However, if the switch is set to 'No', then no hatch lines will be drawn at all. the initial valve of the show hatch switch is 'Y'.

The advantage of not showing hatch lines is that the drawing can be redrawn much faster. Also, if hatch lines are not needed for viewing, the drawing is easier to interpret on the screen without them.

When you select this option, the program will position you to enter either a 'Y' (for Yes) or an 'N' (for No). Press the desired key. Pressing any keys other than 'Y' or 'N' will cause the program to keep the old switch value.

3.10.9 DEBUG

The DEBUG option allows you to turn the 'debug' switch on or off.

This switch is generally used only if the program appears to be working improperly. The information that is displayed when this switch is set to 'Yes' can help the programmers to determine the source of the error. The initial value of the debug switch is 'N'.

When you select this option the program will position you to enter either a 'Y' (for Yes) or an 'N' (for No). Type in the desired letter. Typing any keys other than 'Y' or 'N' will cause the program to keep the old switch value.

3.10.10 ALL LEVELS

The ALL LEVELS option allows you to specify if you want to override the current levels configuration and unconditionally work with all levels.

When the All LEVELS switch is set to 'Yes' all levels are turned on and displayed, regardless of the levels configuration. Setting the switch to 'No' causes the program to use the established levels configuration. The initial value of the All switch is 'Y'.

When you select this option the program will position you to enter either a 'Y' (for Yes) or an 'N' (for No). Type in the desired letter. Typing any keys other than 'Y' or 'N' will cause the program to keep the old switch value.

3.10.11 LEVELS

Refer to section 3.11 of this manual for a description of LEVELS.

3.10.12 SKETCH

Refer to section 3.19 of this manual for a description of the SKETCH option.

3.10.13 QUIT

The QUIT option exits the SWITCHES menu and returns you to the 2D MAIN MENU.

3.11 LEVELS

3.11.1 FUNCTION SELECTION

The LEVELS menu can be selected by choosing the 'L' character from the SWITCHES menu.

The LEVELS menu looks like this:

```
LEVELS:
 [Y] Yes  turns level on
 [N] No   turns level off
 [J] Jump
 [D] Direction
 [T] Tab 10 levels
 [P] Page 40 levels
 [space] moves one level
 [esc] aborts all changes

 [Q] Quit

direction:  forward       level:  1

         1         2         3         4
1234567890123456789012345678901234567890
YYYYYYYYYYNNNNNNNNNNNNNNNNNNNNYYYYYYYYYY
```

3.11.2 PURPOSE

The LEVELS options allows you to access all 250 independent levels. It is from this menu that you are able to selectively turn a level on or off.

For example, if a particular level is turned on, the program will display all of the objects that have been assigned to that level. Further, if a particular level is turned off, the program will display none of the objects assigned to that level. In the example screen shown above, levels 1 through 10 are on, levels 11 through 30 are off, and levels 31 through 40 are on.

The level number currently under review is displayed across from the direction display.

3.11.3 DATA ENTRY

The LEVELS menu only displays 40 levels at a time. Several options have been created to allow you to view and select a particular level.

The PAGE option allows you to view 40 levels at a time. The TAB option moves across 10 levels at a time. To change directions, select the DIRECTION option. This option causes the PAGE, TAB and [space] options to move through the levels in the opposite direction. Initially, movement is in the forward (positive) direction.

The on/off state of a particular level can be displayed or changed by selecting the JUMP option and entering the level number. The program will update the levels display in order to position you at the requested level. Simply press the 'Y' key to turn on the level or the 'N' key to turn off the level.

The [ESC] key can be pressed at any time while the levels are being changed. If this key is pressed, the program will abort all changes made to the 250 levels and return you to the SWITCHES mwnu.

The initial state of all 250 levels is 'Y' (all levels on).

3.11.4 YES

The YES option allows you to turn a particular level on.

To turn on a particular level, position yourself over the desired level. This can be quickly accomplished by selecting the JUMP option. The currently selected level number will be displayed next to the direction display.

Once positioned, press the 'Y' key to turn on the level. You do not need to press the [RETURN] key. The program will automatically advance to the next level.

3.11.5 NO

The NO option allows you to turn a particular level off.

To turn off a particular level, position yourself over the desired level. This can be quickly accomplished by selecting the JUMP option. The currently selected level number will be displayed next to the direction display.

Once positioned, press the 'N' key to turn off the level. You do not need to press the [RETURN] key. The program will automatically advance to the next level.

3.11.6 JUMP

The JUMP option allows you to jump directly to a particular level for changes or viewing.

Rather than paging, tabbing or spacing over to a particular level, you may have a specific level in mind that needs changing. You should use this option for quick access to the desired level. When this option is selected, the program will respond with:

Jump to what level:

Type in the level number you wish to jump to an press the [RETURN] key. The program will update the levels display to reflect the new range of 40 levels and position you to view or change the new current level. The level number display opposite the direction display will also be updated.

3.11.7 DIRECTION

The DIRECTION option allows you to change the direction that you will view or change the 250 levels.

When this option is selected, the program will change the state of the direction display on the LEVELS menu. The DIRECTION option has two states that can be selected: 'forward' and 'backward'.

Initially, the DIRECTION option is set to 'forward'. This means that the 250 levels will be viewed or changed in a positive direction. In other words, your next level position will always be greater than the current level position. If the direction is currently 'backward', then the next level position will always be less than the current level position.

The state of the DIRECTION option does not matter when the JUMP option is used. The JUMP option will always position you on the requested level.

3.11.8 TAB

The TAB option allows you to move through the levels display skipping 10 levels at a time.

If the direction is 'forward' when this option is selected, the program will move forward 10 levels from the current level. If the direction is 'backward' when this option is selected, the program will move backward 10 levels from the current level. For example, if you are currently on level number 75 and the TAB option is selected, the program will position you on level number 85 (assuming direction is set to 'forward').

The program will update the levels display to reflect the new range of 40 levels and position you to view or change the new current level. The level number display opposite the direction display will also be updated.

3.11.9 PAGE

The PAGE option allows you to move through the levels display skipping 40 levels at a time.

If the direction is 'forward' when this option is selected, the program will move forward 40 levels from the current level. If the direction is 'backward' when this option is selected, the program will move backward 40 levels from the current level. For example, if you are currently on level number 75 and the PAGE option is selected, the program will position you on level number 115 (assuming direction is set to 'forward').

The program will update the levels display to reflect the new range of 40 levels and position you to view or change the new current level. The level number display opposite the direction display will also be updated.

3.11.10 [SPACE]

The [SPACE] option allows you to move through the levels display one level at a time.

If the direction is 'forward' when this option is selected, the program will move forward one level from the current level. If the direction is 'backward' when this option is selected, the program will move backward one level from the current level. For example, if you are currently on level number 75 and the [SPACE] option is selected the program will position you on level number 76 (assuming direction is set to 'forward').

The program will update the levels display to reflect the new range of 40 levels and position you to view or change the new current level. The level number display opposite the direction display will also be updated.

3.11.11 QUIT

The QUIT option allows you to exit the LEVELS menu and return to the SWITCHES menu. Any changes that were made to the 250 levels will be made permanent.

3.12 WINDOW

3.12.1 FUNCTION SELECTION

The WINDOW menu can be selected by choosing the 'W' character from the 2D program MAIN MENU.

The WINDOW menu looks like this:

```
WINDOW:
 [B] Base
 [I] In
 [O] Out
 [F] Full
 [D] Delete
 [G] Get
 [S] Save
 [W] What
 [L] List
 [R] Redraw
 [K] sKetch
 [Q] Quit
 [?] Help
```

3.12.2 PURPOSE

The WINDOW option allows you to manipulate the current viewing 'window'. To understand a window, imagine that the screen is a moving 'window' through which you view your drawing. The WINDOW options allow you to move, shrink and magnify your viewing window.

Windows are used to work on a portion of the drawing at a level of greater or lesser detail. They 'blow up' or 'shrink' the drawing that is displayed on your screen.

3.12.3 DATA ENTRY

Windows are created by setting up a 'window rectangle' and then moving that rectangle to surround the area of the screen to be examined. Both the creation and movement of the window rectangle are done using the cursor. Once the window rectangle is positioned and sized correctly, it is accepted and the windowed view of the drawing will then be displayed. In order to prevent distortion of the drawing, all window rectangles are created with the same proportions as the viewing screen.

If, for any reason, you have mistakenly accepted a new window, i.e., IN, OUT, FULL or GET, and you do not want to continue the drawing process, then simply hit the [ESC] key. This action will cause the drawing process to halt and wait for another menu selection. Objects drawn on the screen before you pressed the [ESC] key are now the only parts of the drawing accessible. For example, in MODIFY only those objects on the screen can be blinked (or pointed to) and the SKETCH option will only redraw these objects left on the screen.

To force the screen to redraw the entire workfile of objects, simply select the REDRAW option off the WINDOW menu. This action will not change the current window and will draw the missing objects (if there are any) previously not drawn by invoking the [ESC] option.

3.12.4 BASE

The BASE option allows you to redisplay the base window defined for this drawing.

The base window is an arbitrary, user definable, screen coordinate system that is meant to be used as the basic coordinate system while creating a drawing. It is defined by using the BASE option of the UNITS menu. The initial base window is 0-279 in the X direction and 0-191 in the Y direction.

When you first enter the 2D program, you are at the base window. It is a starting point at which you begin a drawing. During the course of creating a drawing, you may have windowed 'in' or 'out' several times. At any time you can return to the base window by typing the 'B' key from the WINDOW menu.

3.12.5 IN

The IN option allows you to magnify a small portion of the drawing and display it on the entire screen.

A window 'in' is defined by two characteristic points:

1) This point defines the first corner of the desired window.
2) This point defines the opposite corner of the window.

When this option is selected, the program will ask you to enter the first corner of the desired window. Move the cursor to position the first characteristic point and press the cursor button. The program will now repeatedly draw a rectangle on the screen. This rectangle is a representation of the window. It will grow or shrink as you move the cursor. When the rectangle surrounds the portion of the drawing that you wish to magnify, accept it by pressing the cursor button. The screen will immediately be updated to show the magnified portion of the drawing.

The 2D program will not allow you to window IN indefinitely. If the requested window would cause the program to lose numeric precision (see section 2.22 of this manual), then the window IN request will be denied.

Special keyboard options are available that allow you to interactively change and control the window IN function. These keyboard options are displayed on a menu line along the side of the screen.

The keyboard options available while windowing IN are:

'S': causes the blinking window to grow or shrink depending on the cursor location. You are initially in this mode.
'M': allows you to move the blinking window across the screen using the cursor. Moving the window does not change its size.
'P': fixes the size and location of the blinking window and allows you to move the cursor without affecting the window.
[ESC]: aborts the window IN operation.

3.12.6 OUT

The OUT option allows you to take the image displayed on the screen, and shrink it into a selected area of the screen.

A window 'out' is defined by two characteristic points:

1) This point defines the first corner of the desired window.
2) This point defines the opposite corner of the window.

When this option is selected, the program will ask you to enter the first corner of the desired window. Move the cursor to position the first characteristic point, and press the cursor button. The program will now repeatedly draw a rectangle on the screen. This rectangle is a representation of the window. It will grow or shrink as you move the cursor. When the rectangle surrounds the area that you wish to shrink the screen into, accept it by pressing the cursor button. The screen will immediately be redrawn. The original screen has now been reduced to fit into the area defined by the new window. Objects that were previously off the screen may now be visible.

The 2D program will not allow you to window OUT indefinitely. If the requested window would cause the program to lose numeric precision (see section 2.22 of this manual), then the window OUT request will be denied.

Special keyboard options are available that allow you to interactively change and control the window OUT function. These keyboard options are displayed on a menu line along the side of the screen.

The keyboard options available while windowing OUT are:

'S': causes the blinking window to grow or shrink depending on the cursor location. You are initially in this mode.
'M': allows you to move the blinking window across the screen using the cursor. Moving the window does not change its size.
'P': fixes the size and location of the blinking window and allows you to move the cursor without affecting the window.
[ESC]: aborts the window OUT operation.

3.12.7 FULL

The FULL option creates and displays the smallest window that contains your entire drawing.

When this option is selected, the program will read the entire database and calculate the smallest window. All objects will then be drawn on the new window. This option is useful if you think you have 'lost' part of your drawing or just want a full or complete view of your work.

If you accidentally selected this option or changed your mind, you can press the [ESC] key to abort the calculations. Since this option takes a considerable amount of calculation time (especially when large drawings are being created), there should be a means to abort the process.

If the [ESC] key is pressed before the program begins to desplay the new window, the program will leave the current window intact. If the [ESC] key is pressed after the program displays the new window, the program will stop drawing objects and leave the 'full' window intact.

3.12.8 DELETE

The DELETE option allows you to delete any previously SAVED windows from your workfile.

When this option is selected, the program will ask:

Delete what window ?

Enter the name (up to 7 characters in length) of the window that you wish to delete from the workfile, and hit the [RETURN] key. If you do not wish to delete a window, then only hit the [RETURN] key in response to the prompt.

The program will print a message telling you that the window does not exist if it cannot find the window in the workfile. If it can find the window, it will ask:

Are you sure (Y/N) ?

Answer with a 'Y' if you are sure that you want to delete the window and answer 'N' if you wish to abort the operation.

3.12.9 GET

The GET option allows you to get any window that has been previously SAVED in your workfile.

When this option is selected, the program will ask:

Get what window ?

Enter the name (up to 7 characters in length) of the window through which you wish to view your drawing, and hit the [RETURN] key. If you do not wish to get a window, then only hit the [RETURN] in response to the above prompt.

If the window does not exist in your workfile, the program will print a message telling you that it could not find the window. If the window is in the workfile, the program will immediately redraw your drawing using the selected window. You might notice quite a change in your drawing, i.e., it may have been blown up or scaled down. This is because the program remembered how that particular window made your drawing appear.

3.12.10 SAVE

The SAVE option allows you to save the window through which you are currently viewing your drawing. Windows are saved in your workfile.

When this option is selected, the program will ask:

Save as what window ?

Enter the name (up to 7 characters in length) that you wish to give to this window, and hit the [RETURN] key. If you do not wish to save a window, then only hit the [RETURN] in response to the above prompt.

The program will not let you save two windows with the same same. So, if there is a window with the name that you just entered, the program will ask:

Window already exists, replace (Y/N) ?

If you do wish to replace the old window, then answer with a 'Y' and the program will try to save the window. If you don't, then answer with an 'N' and the program will leave the SAVE option. You will be allowed to save up to 19 windows and plot specs in your workfile. The more windows you save, the fewer plot specs you can create.

If the program could successfully save the window, it will print a message telling you everything went ok. A message will be printed if the program cannot save the window.

3.12.11 WHAT

The WHAT option tells you the absolute real world limits of our current viewing window.

3.12.12 LIST

The LIST option allows you to list all of the windows by name that are saved in your workfile. This option is quite useful when you cannot remember the name of a previously saved window.

3.12.13 REDRAW

The REDRAW option allows you to force the program to redraw all of the objects in the workfile at the current window.

This option is used in conjunction with the [ESC] out of any window option, the SKETCH option and the GET in FILER option. If you had typed the [ESC] option too early while the program was changing the window and prevented some objects from being drawn, then the REDRAW option will redraw the entire workfile for you without altering the current window.

3.12.14 SKETCH

Refer to section 3.19 of this manual for a description of the SKETCH option.

3.12.15 QUIT

The QUIT option allows you to exit the WINDOW menu and return to the 2D program MAIN MENU.

3.13 LIBRARY

3.13.1 FUNCTION SELECTION

The LIBRARY option is selected by pressing the 'L' character from the MAIN MENU.

The LIBRARY menu looks like this:

LIBRARY:

[M] Make
[D] Delete
[L] List
[N] New
[O] Overlay
[G] Group
[R] dRive
[C] Crunch
[W] What
[K] sKetch
[Q] Quit
[?] help

3.13.2 PURPOSE

The LIBRARY option allows you to make, delete and otherwise manipulate 'group libraries'.

A group is a user defined collection of objects. Groups within a library usually have a specific configuration or appearance. For example, one group might be a door, another might be a machine screw and still another might be an integrated circuit component. The objects that form each of these useful groups have one element of commonality: their group name. Thus, a group is created by assigning various objects in the drawing the same group name.

A group library consists of a maximum of 100 groups. The groups within a library are numbered 1 through 100 (starting left to right, bottom to top). A library is nothing more than a place to store groups for future use. Some users prefer to arrange their libraries by group type. For example, you might create a library that holds nothing but machine screws of various legths, threads per inch and diameter, or you might store the most commonly used TTL low-power schottky integrated circuit components, or you might store various door sizes.

On the other hand, some users prefer to store groups of different types in their libraries. For example, you might store all types of commonly used architectural groups such as doors, windows, stairs, and furniture, or you might store all types of electronic groups such as integrated curcuits, resistors, capacitors and diodes. The possibilities are limited only by your imagination.

Once you have set up your group libraries, you can easily retrieve a group from any library by using the GROUP option off the ADD menu. You will be asked to select one of the 100 groups from the currently defined library. Once a group is selected, you may place it on your drawing.

Libraries will save you hours of work since you do not have to recreate those commonly used groups such as a door, integrated circuit or standard note. Once a group is created and placed into its library, it can be used over and over again.

3.13.3 DATA ENTRY

Almost all data is entered from the keyboard. Pressing the [ESC] key while in any LIBRARY option immediately aborts that operation and returns you to the LIBRARY menu.

Group libraries are stored on a library disk. It is recommended that a newly formatted disk be dedicated to a single library. This allows the library to 'grow' without having to worry about any disk space problems. You can have as many library disks as you need in order to save your libraries.

The library disk drive number is initially defined by the ENVIRO program to be disk drive #5. This can be changed at any time using the DRIVE option described later in this section. Note that the library disk drive number and the drawing file disk drive number are not the same.

All of the options off the LIBRARY menu that need to reference libraries will look at the library disk drive. The followning procedure outlines how to use your library disks:

1. Select the LIBRARY option off the MAIN MENU.
2. Select the WHAT option off the LIBRARY menu.
3. If the library disk drive is set to #5 then go to step #6.
4. Select the DRIVE option off the LIBRARY menu.
5. Change the library disk drive to be #5.
6. Select the appropriate LIBRARY option (MAKE, LIST, OVERLAY, etc.)
7. Remove the 'CODE' disk from drive #5.
8. Place the library disk into drive #5.
9. Press the [RETURN] key to continue.
10. Answer all questions regarding the LIBRARY option selected.
11. Place the 'CODE' disk into drive #5.

3.13.4 MAKE

The MAKE option allows you to make a new group library on the disk in the library disk drive. When this option is selected, the program will ask:

```
Place library disk into drive #5.
Press [RETURN] to continue.
```

The program is now waiting for you to swap disks if necessary. For example, you may have to remove the 'CODE' disk and insert a library disk. When you are ready to continue, press the [RETURN] key. The program will then ask:

```
Make what library?
```

Enter the new library name (up to 8 characters in length) and press the [RETURN] key. the program will then create the group library on the disk in the library disk drive and display a message confirming that the library was successfully made. The new library will be initialized and all 100 group positions will contain no information.

If the library you want already exists, then the program will ask you to verify that you want to destroy the original. If you still want to make this library, the program will continue and destroy the original library.

If the program could not create the library because of a lack of room, then the program will tell you. The initial size of a library is 60 blocks. This will allow you to add approximately 100 groups that average 4 objects per group. If for some reason this is not enough room, then the program will automatically enlarge the library to accomodate the extra objects. In other words, the library will 'grow' larger so that larger groups can be stored. Again, as a suggestion, please store only one library per disk. It will be easier for the library to grow larger if this is done.

3.13.5 DELETE

The DELETE option allows you to delete an entire group library from the disk in the library disk drive. When this option is selected, the program will ask:

```
Place library disk into drive #5.
Press [RETURN] to continue.
```

The program is now waiting for you to swap disks if necessary. For example, you may have to remove the 'CODE' disk and insert a library disk. When you are ready to continue, press the [RETURN] key. The program will then ask:

```
Delete what library?
```

Enter the library name (up to 8 characters in length) and press the [RETURN] key. The program will search for the library on the library disk. If it found the library, the program will ask for verification that you really want to delete this library:

```
Proceed with Delete (Y/N)?
```

Pressing the 'Y' key will cause the program to delete the library from the library disk. Pressing the 'N' key will abort this operation.

3.13.6 LIST

The LIST option lists the names of all the libraries stored on the disk in the library disk drive. When this option is selected, the program will ask:

```
Place library disk into drive #5.
Press [RETURN] to continue.
```

The program is now waiting for you to swap disks if necessary. For example, you may have to remove the 'CODE' disk and insert a library disk. When you are ready to continue, press the [RETURN] key. The program will then proceed to list all libraries on the library disk. A sample display produced by the LIST option might be:

```
Libraries on drive #5:
ARCH    MECH    ELEC
```

This option is quite useful if you cannot remember what libraries are stored on a library disk.

3.13.7 NEW

The NEW option allows you to change the 'current library'. The current library is the library from which you perform such functions as add groups to your drawing or produce a library overlay. It is not necessary to have the library disk in the library disk drive in order to use this option.

When this option is selected, the program will display the following message:

```
Current library:  ARCH
Enter new current library:
```

Enter the new current library name (up to 8 characters in length) and press the [RETURN] key. Remove the library overlay that is currently taped to your digitizer. For each group library that you have created, you should have plotted out its 10 by 10 matrix overlay. At this time, place the new current library's overlay on the digitizer.

The program will now ask that you define the extreme lower left hand corner of the current library's overlay. Move the cursor to this position and press the cursor button. Next, the program will ask that you define the extreme upper right hand corner of the current library's overlay. Move the cursor to this position and press the cursor button. You have now changed the current library. The program will display a message confirming that the current library has been successfully changed.

3.13.8 OVERLAY

The OVERLAY option allows you to create a plotter ready overlay 'menu' for the currently active group library.

A group library overlay is a 10 by 10 matrix of boxes. Each box contains a group from the group library. This overlay is designed to be placed on the surface of the digitizer. You can secure the overlay to the digitizer with a couple pieces of tape. The function of the overlay is to allow you to place a group (pictured on the overlay) on your drawing. This is most commonly done using the GROUP option off the ADD menu.

When this option is selected, the program will ask:

```
Place library disk into drive #5.
Press [RETURN] to continue.
```

The program is now waiting for you to swap disks if necessary. For example, you may have to remove the 'CODE' disk and insert a library disk. When you are ready to continue, press the [RETURN] key. If your workfile contains any information, the program will not be able to create the desired overlay and will display the following message:

> Cannot create the library overlay.
> The workfile must not contain any information.

Use the NEW option off the FILER menu to clear all information from the workfile and try the OVERLAY option again. If the workfile is already empty, the program will display the following message:

> Please wait while the library overlay
> is created. Press [ESC] to abort.

At this time, the program will change the base window parameters to accomodate the 10 by 10 matrix of groups. Next, the program will begin to draw the library overlay on the screen. When the overlay is completed the program will display the following message:

> The overlay has been created. A plot specs called
> 'OVERLAY' has been placed in the workfile.

In order to plot this overlay for use, select the PLOTTER option off the OUTPUT menu. When the library overlay was created, the program automatically created a plot specs called 'OVERLAY' that has all of the necessary plotting parameters predefined. You should use this plot specs to automatically scale the matrix so that it just fits on the surface of the digitizer.

When you select the OVERLAY option, the program might display the following error message:

> Cannot complete the library overlay.
> There is no more room in the workfile.

The program is informing you that the workfile must be made larger. There is currently not enough room in your workfile to store all of the library information. The OVERLAY option will generate 22 lines, 100 text objects and up to 100 groups. So, be sure that your workfile is big enough.

3.13.9 GROUP

Refer to section 3.14 of this manual for a description of the GROUP option.

3.13.10 DRIVE

The DRIVE option allows you to change the library disk drive number. The library disk drive is where the program will look for the libraries stored on the library disk. When this option is selected, the program will ask:

```
Enter new default library drive #:
```

Enter one of the appropriate drive numbers: 4,5,9,10,11,12 followed by the [RETURN] key. For example, if the library disk drive number was set to #5 by the ENVIRO program and you need to access a library on drive #9, then simply change the drive number to #9 using this option. This change will remain as long as you are running the program. The next time you run the program, the program will return to the value specified by the ENVIRO program.

3.13.11 CRUNCH

The CRUNCH option allows you to 'crunch' a group library. When this option is selected, the program will ask:

```
Place library disk into drive #5.
Press [RETURN] to continue.
```

The program is now waiting for you to swap disks if necessary. For example, you may have to remove the 'CODE' disk and insert a library disk. When you are ready to continue, press the [RETURN] key. The program will display the following message:

```
Please wait while the current library
is being crunched...
```

The program will begin to crunch the current library. When the operation is finished, the program will display a confirming message.

The process of adding and deleting groups from a group library can leave empty (and unusable) 'holes' in the library. Crunching the library will remove these holes, thus, freeing up this space and making it usable again.

This option should be used only if the program displays a message informing you that there is no more room in the current library to add a group. Using the CRUNCH option may create the needed room.

If the CRUNCH option does not create the needed room, then it will be necessary to physically move the library on the disk to allow it to grow larger. This can be accomplished by using the Pascal operating system FILER option in either one of these two ways:

1. Transfer the library to a new, blank disk.
2. Transfer the library to a location on the current disk where there are no files stored immediately after the library. This will allow the library file to grow larger.

3.13.12 WHAT

The WHAT option displays the current library name and the default library disk drive number. When this option is selected, the program will display the following message:

```
Current library:  ARCH
Default library drive is #5
```

This option is useful for verifying that you are indeed searching for a particular library on the correct drive number.

3.13.13 SKETCH

Refer to section 3.19 of this manual for a description of the SKETCH option.

3.13.14 QUIT

The QUIT option allows you to leave the LIBRARY menu and return to the MAIN MENU.

3.14 GROUP

3.14.1 FUNCTION SELECTION

The GROUP option is selected by pressing the 'G' character from the LIBRARY menu.

The GROUP menu looks like this:

GROUP:

[A] Add
[D] Delete
[N] group Name
[L] List
[K] sKetch
[Q] Quit
[?] help

3.14.2 PURPOSE

The GROUP option allows you to add, delete, rename, and otherwise manipulate the individual groups stored in the current library.

This option allows you to manage the groups saved in the current library. It is from this menu that you can ADD new groups to the current library, or DELETE groups from the current library, or even get a complete listing of all the groups in the current library.

Groups are a user defined collection of objects. They can be doors, windows, machine screws, integrated circuits or piping symbols. A group is created in the workfile and then added to the current library for future use. Groups can be added to the current library from a saved drawing file as well.

3.14.3 DATA ENTRY

Almost all data is entered from the keyboard. Pressing the [ESC] key while in any GROUP option immediately aborts that operation and returns you to the GROUP menu.

All of the options off the GROUP menu assume that you are working on the current library. The current library is defined by the NEW option off the LIBRARY menu.

Group libraries, especially the current library, are stored on the library disk in the library disk drive. The GROUP options will look at the default library disk drive for the current library. To change the library disk drive number, select the DRIVE option off the LIBRARY menu.

3.14.4 ADD

The ADD option allows you to add a group to the current library which is in the library disk drive. When this option is selected, the program will ask:

```
Enter file name containing group to add
([RETURN] for workfile)?
```

If the group you want to add to the current library is in the workfile, then simply press the [RETURN] key. If the group you want to add is in a previously saved drawing file, then enter the drawing file name (up to 8 characters in length) and press the [RETURN] key. The program will display the following message:

```
Enter name of desired group:
```

Enter the name of the group you want to add to the current library (up to 7 characters in length) and press the [RETURN] key. The program will display the following message:

```
Group number to add (1..100)?
```

Enter the number (1 through 100) that the new group will be given in the current library and press the [RETURN] key. The primary importance of this number is that it determines where on the library overlay the group will be drawn. Group number one is drawn in the lower left hand corner, group number two is drawn one box to the right and group number 100 is drawn in the upper right hand corner.

If you are retrieving a group from a saved drawing file, then the program will display the following message. Otherwise, the program will transfer the group from the workfile to a temporary storage area.

```
Place the datafile disk into drive #5
Press [RETURN] to continue.
```

The program is now waiting for you to swap disks if necessary. For example, you may have to remove the 'CODE' disk and insert the drawing file disk. When you are ready to continue, press the [RETURN] key. The program will read the group from the saved drawing file into a temporary storage area.

Once the transfer of the group to the temporary storage area is completed, the program will display the following message:

```
Place the library disk into drive #5
Press [RETURN] to continue.
```

The program is now waiting for you to swap disks if necessary. For example, you may have to remove a disk and insert the current library disk. When you are ready to continue, press the [RETURN] key. The program will search the library to check if a group already exists at the requested library number. If a group already exists at that library number, the program will display the following message:

```
Group already exists in library.
Proceed with Add (Y/N)?
```

Pressing the 'Y' key will cause the program to destroy the old group and replace it with the new group. Pressing the 'N' key will abort this operation.

Once the group has been successfully added to the current library, the program will display a confirming message.

3.14.5 DELETE

The DELETE option allows you to delete a group from the current group library in the library disk drive. When this option is selected, the program will display the following message:

```
Place the library disk into drive #5
Press [RETURN] to continue.
```

The program is now waiting for you to swap disks if necessary. For example, you may have to remove the 'CODE' disk and insert the current library disk. When you are ready to continue, press the [RETURN] key. The program will display the following message:

```
Proceed with Delete (Y/N)?
```

Pressing the 'Y' key causes the program to remove this group from the current library and display a confirming message. Pressing the 'N' key will abort this operation. You should note that when a group is deleted from the current library, there is no means of undeleting that group. So, be sure that you really do not want the group.

3.14.6 GROUP NAME

The NAME option allows you to change the name of a particular group stored in the current library. This option is selected, the program will display the following message:

```
Place library disk into volume #5
Press [RETURN] to continue.
```

The program is now waiting for you to swap disks if necessary. For example, you may have to remove the 'CODE' disk and insert the current library disk. JWhen you are ready to continue, press the [RETURN] key. The program will display the following message:

```
Group number to rename (1..100)?
```

Enter the number (1 through 100) of the group you want to rename and press the [RETURN] key. The program will display the following message:

```
Enter replacement group name:
```

At this time, enter the replacement group name (up to 7 characters in length) and press the [RETURN] key.

If you imbed the character sequence '...' in the replacement group name, then the program will automatically number this group each time you select it from the library. I this character sequence is not imbedded in the replacement group name, then the program will not number the group. It is recommended that you imbed this sequence in the group name so that the program will assign each group that you use from the library a unique group name.

Once the group name has been successfully changed, the program will display a confirming message.

3.14.7 LIST

The LIST option allows you to list all of the groups stored in the current library. When this option is selected, the program will display the following message:

```
Place the library disk into drive #5
Press [RETURN] to continue.
```

The program is now waiting for you to swap disks if necessary. For example, you may have to remove the 'CODE' disk and insert the current library disk. When you are ready to continue, press the [RETURN] key. The program will list all of the groups by name and number that are stored in the current library. A partial listing might look like this:

```
Groups in the library:  ARCH

1. DOOR       2. WINDOW      3. CHAIR
4. SWITCH     5. FIXTURE     6. SOCKET
7.            8.             9.
```

3.14.8 SKETCH

Refer to section 3.19 of this manual for a description of the SKETCH option.

3.14.9 QUIT

The QUIT option allows you to leave the GROUP option and return to the LIBRARY menu.

3.15 HATCH

3.15.1 FUNCTION SELECTION

The HATCH option is selected by pressing the 'H' character from the MAIN MENU.

The HATCH menu looks like this:

HATCH:

[P] Pick
[I] Inquire
[H] Hatch
[D] Delete
[W] What
[K] sKetch
[Q] Quit
[?] help

3.15.2 PURPOSE

The HATCH option provides a quick and easy method for automatically creating equally spaced parallel lines on any angle within an area bordered by objects and text. Several steps are required to perform these operations and they are described in the sections below.

Applications include:

1. Mechanical drafting, the production of section lines for an object's cut or broken surface.

2. Architectural drafting, the cross-hatching of walls, patios and other sectional views.

3. Other disciplines can take advantage of this option. If there is a need to fill an area of a drawing with a solid color, then using very closely spaced hatch lines will do the trick.

3.15.3 DATA ENTRY

A few general words about the HATCH option should help you understand how to use it. Before you can hatch, you must tell the program the specific area of the drawing that it is to use. The area is defined as a space on your drawing that is bordered by various objects, e.g., lines, rectangles, circles and others. The following steps ouline the general idea:

1. Select the PICK option from the HATCH menu. Pick an object that borders the area to be hatched. If you selected a line, you will be asked if all or part of the line borders the hatch area. If you picked any other object, you will be asked if the program found the correct object. If you picked the wrong object, press the 'N' key. When all of the objects that border the hatch area have been picked, press the 'Q' key. The program will calculate the exact border of the hatch area.

2. Select the INQUIRE option from the HATCH menu. The program will continually blink all of the border line segments that surround the hatch area. This is a visual verification that the program will hatch the correct area of your drawing.

3. Select the HATCH option from the HATCH menu. Enter the desired hatch parameters such as spacing, angle and hatch number. The program will now insert the correctly spaced parallel lines into the specified area of your drawing. You should note that when the hatch lines are created, they are placed into your workfile as regular lines (no compaction takes place). This also means that the hatch lines will assume all of the global default properties such as linestyle, color, level and others.

If any error messages are displayed, refer to section 3.15.11 for a more detailed description on probable causes and possible solutions.

3.15.4 PICK

The PICK option allows you to define the borders that surround the hatch area.

When this option is selected, the program will ask that you pick the object that borders the hatch area. First, find an object on the screen that borders the hatch area. Second, be sure that all of the parts of the object that border the hatch area are completely on the screen.

If you are about to pick an object other than a line, then it does not matter where you place your pick point. Once you have picked the object, the program will ask for verification that it found the correct object. After verification is made, select the next object that borders the hatch area.

If you are about to pick a line, use the following two simple rules to help you determine where to pick that line:

1. If only part of the line borders the hatch area, then place your pick point on the portion of the line that borders the hatch area.

2. If all parts of the line border the hatch area, then it does not matter where you place your pick point.

After you have picked the line, the program will display the following menu and begin blinking the line.

```
PICK:

 [A] All
 [P] Partial
 [N] None

 [ESC] aborts
```

If the line that is blinking is not correct, then select the NONE option from the PICK menu. The program will allow you to re-pick the correct line. Sometimes the objects on you drawing are very close together and it is very difficult to pick the correct line. To get around this problem, repeatedly pick the line at the same location until the program finds the correct line.

If the line blinking is correct, then you must make a decision. The program must know if the line partially or completely borders the hatch area. If the line completely borders the hatch area, then select the ALL option from the PICK menu. If the line partially borders the hatch area, then select the PARTIAL option from the PICK menu.

If you need to use the ALL option, the program will ask you to pick the next object that borders the hatch area. If you need to use the PARTIAL option, then there must be two points on the line that intersect with another object. You must now define these two intersection points. To do this, place the cursor on the first intersection point and press the cursor button. Next, place the cursor on the second intersection point and press the cursor button. after both intersection points have been entered, the program will ask you to pick the next object that borders the hatch area.

When all of the objects have been picked, select the QUIT option off the PICK menu. The program will go on to calculate the exact border of the hatch area. Once the calculations have been performed, the HATCH menu will be displayed.

If at any time you need to abort the PICK option, simply press the [ESC] key and the HATCH menu will be displayed.

3.15.5 INQUIRE

The INQUIRE option allows you to verify that the boundaries the program created for the hatch area are indeed correct.

Once the option has been selected, the program will continually blink each border segment of the hatch area. To stop the blinking of the boundary line segments and return to the HATCH menu, simply press the [RETURN] key. If the hatch area has not been defined using the PICK option, then the program will respond with an appropriate error message.

3.15.6 HATCH

The HATCH option allows you to insert equally spaced parallel lines on any angle into a predefined area of your drawing.

Once this option is selected, the program will respond with the following input screen:

```
Enter hatch parameters:
    hatch spacing   1.0000
    hatch shift     0.0000
    hatch angle     45.0000
    hatch number    1

    [RETURN] defaults to value shown,
    [ESC]    aborts.
```

The program will position you to enter each of the above hatch parameters in the order shown. If you want to use the parameter shown, then simply press the [RETURN] key and the program will use the displayed parameter. If any of the parameters need to be changed, then read the following paragraphs that describe each parameter in detail.

The hatch spacing parameter refers to the perpendicular distance between any two parallel hatch lines. Initially, it is set to the current value of the 'smallest increment'. Enter any real world coordinate for the spacing followed by the [RETURN] key.

The hatch shift parameter allows you to create double-line hatching on your drawing. If you are not planning on using double-line hatching then leave the shift set to 0.0000. Otherwise, enter any real world coordinate for the shift followed by the [RETURN] key. Note that if your shift entry is greater than or equal to the hatch spacing, then it will be adjusted to an integral amount less than the hatch spacing. The hatch shift is initially set to 0.0000.

The hatch angle parameter allows you to specify the precise angle (in degrees) that the hatch lines are to be created. The angle is measured from the horizontal with a counter-clockwise direction. The number you enter can be any real number within the range -360.0000 degrees to 360.0000 degrees. Enter a number within this range followed by the [RETURN] key. the program will adjust all entries to fall within the range of 0.0000 degrees to 360.0000 degrees. The hatch angle is initially set to 45.0000 degrees.

The hatch number parameter allows you to identify the hatch lines you are about to create with a specific number. This is useful when you need to use the DELETE or WHAT option from the HATCH menu. Deleting a group of unwanted hatch lines can now be a simple task. Enter an integer number 1 to 32767 followed by the [RETURN] key. The hatch number is initially set to 1.

Once all parameters have been entered, the program will begin inserting lines into the hatch area. Note that the current viewing window on the screen must completely contain the area to be hatched. If it does not, then an error message will bew displayed and hatching aborted.

If the hatch area has not been defined correctly with the PICK option, the program will respond by telling you that it cannot hatch the area, since no boundaries are defined.

3.15.7 DELETE

The DELETE option allows you to delete a set of hatch lines by their hatch number.

Once this option is selected, the program will respond with:

    Delete what hatch number?

Enter the number the hatch lines were labelled with at the time they were created and press the [RETURN] key. The program will then search for all hatch lines labelled with the specified number and delete them from the drawing.

3.15.8 WHAT

The WHAT option allows you to ask where a particular set of hatch lines are located on your drawing.

Once this option is selected, the program will respond with:

Show what hatch number?

Enter the number the hatch lines were labelled with at the time they were created and press the [RETURN] key. The program will then search for all hatch lines labelled with the specified number. As it finds each hatch line it will blink it once. Press the [RETURN] key to stop the blinking and return to the HATCH menu.

3.15.9 SKETCH

Refer to section 3.19 of this manual for a description of the SKETCH option.

3.15.10 QUIT

The QUIT option allows you to exit the HATCH menu and return to the MAIN MENU.

3.15.11 ERROR HANDLING

Since the HATCH option implements a rather complicated algorithm to insert lines into a specified area, you might receive some unexpected results and/or error messages. These situations may result from a misunderstanding of a particular HATCH option. If there is a problem, then the program might output one of the error messages below. These explanations attempt to describe probable causes and possible solutions.

> Cannot create hatch boundary. The area picked is not completely enclosed. Press [RETURN] to continue.

The above error message describes a common problem associated with creating hatch lines. The area you just picked is not completely enclosed, i.e., the hatch area is not bordered on all sides by objects. If it is completely enclosed, then you were not accurate enough when you picked the objects and their intersection points. If you believe that you were quite accurate, then verify that intersecting objects actually do intersect. This can be accomplished by windowing in around the suspected intersection(s) for verification.

> The area is too large. Use template lines to divide the area and try again. Press [RETURN] to continue.

The above error message describes a run time space problem. This message can be caused by several events during the hatch process. If this message appears, then you must divide the area in two pieces. This can be done by placing a template line through the hatch area. Once the template line is entered, proceed to hatch each half of the hatch area separately. If the area is still too large, then continue dividing down the hatch area as described above.

3.16 INQUIRE

3.16.1 FUNCTION SELECTION

The INQUIRE menu is selected by pressing the 'N' character from the MAIN MENU.

The INQUIRE menu looks like this:

INQUIRE:

[O] Objects
[D] Drawing
[M] Measure
[R] dRive
[W] What
[K] sKetch
[Q] Quit
[?] help

3.16.2 PURPOSE

The INQUIRE option allows you to request specific information concerning your drawing.

For example, you can have the following information displayed for you: beginning and ending points of a line, the radius of a circle, the distance between two points, the area and perimeter of a rectangle, which levels are used in a drawing and much more.

3.16.3 DATA ENTRY

The INQUIRE option gives you access to specific information about your drawing. All of the options off the INQUIRE menu display information in a specific format and each option has a specific purpose described as follows:

1. If you require specific information about an object on your drawing (such as initial position, rotation, length or area), then you will need to select the OBJECTS option.
2. If you require information concerning how many of the 250 levels are currently being used or how many plotter pens are necessary to plot, then you will need to select the DRAWING option.
3. If you need specific measurements on your drawing (such as area, length or rotation), then you need to select the MEASURE option.

You will notice that there are ADD and SUBTRACT options off the MEASURE and OBJECTS menus. These options allow you to sum areas and perimeters of objects and measurements. You may move between the OBJECTS option and the MEASURE option in order to interactively sum the area and the perimeter of objects and measurements. As long as you remain in the INQUIRE menu, the program will remember these totals. When you initially select the INQUIRE option off the MAIN MENU the program will zero these totals.

3.16.4 OBJECTS

The OBJECTS option calculates and displays the various geometric characteristics of a selected object.

When this option is selected, the program will search for the last object on the drawing. If the last object happens to be a line, the program will display the following information:

```
 OBJECTS:
This object is a line with:
 beginning     X:  46.0000   Y:  113.0000
 end           X:  99.0000   Y:  150.0000
 change        X:  53.0000   Y:   37.0000
 length:           64.6375
 rotation:         34.9194

Totals:
 area:              0.0000
 perimeter:         0.0000

  [A] Add to totals
  [S] Subtract from totals
  [Z] Zero totals

  [>] move forward      [F] Find
  [<] move backward     [Q] Quit
  [?] help
```

This display reflects the specific geometric characteristics of the line. Notice that the line's beginning and ending points, change in direction, rotation and length are all shown. This information can be used later. For example, you might want to precisely connect an arc's endpoint to the beginning point of this line. The information given here will allow you to use the ABSOLUTE input mode and directly enter the arc's coordinates.

The geometric characteristics of all the other objects (circles, text, rectangles etc.) are different than those shown here for a line. When another type of object is selected, the program will automatically update the display to reflect the proper characteristics. The characteristics displayed for other objects are self-explanatory and easy to follow. Some examples of other characteristics are:

```
center   - center of an arc or circle.
area     - area enclosed by a circle, rectangle or polygon.
length   - circumference of circles or perimeter of rectangles.
rotation - rotation of a line, rectangle, Bezier curve, etc.
radius   - radius of an arc, circle or polygon.
change   - change in direction of lines and rectangles.
```

It is important that you remember the following points:

1. All coordinate points displayed and measurements made are expressed in 'real world coordinates'.

2. Rotation is always expressed in degrees and measured counter-clockwise from the horizontal axis.

The OBJECTS menu options available are:

'A' : Causes the program to add the current object's area and perimeter (if available) to the totals field.

'S' : Causes the program to subtract the current object's area and perimeter (if available) from the totals field.

'Z' : Causes the program to clear (zero) the totals field.

'F' : Allows you to select any object on your drawing by picking it with the cursor. This option is identical in operation to the FIND option off the MODIFY menu. Once the object is found, the program will update the geometric characteristics.

'>' : Allows you to sequentially move forward through the list of objects on your drawing. This option is identical in operation to the move forward option off the MODIFY menu. Once the object is found, the program will update the geometric characteristics.

'<' : Allows you to sequentially move backward through the list of objects on your drawing. This option is identical in oeration to the move backward option off the MODIFY menu. Once the object is found, the program will updat the geometric characteristics.

'Q' : Causes the program to leave the OBJECTS option and return to the INQUIRE menu.

3.16.5 DRAWING

The DRAWING option displays a summary of the levels and plotter pens used by a drawing.

When this option is selected, the program will display the following message:

```
Inquire information about what drawing
([RETURN] for workfile)?
```

If you would like to see a summary of the current workfile, then only press the [RETURN] key. If you want to view a summary of a drawing file that has been previously saved, then type the name of the drawing file followed by the [RETURN] key.

The computer will then display the following:

```
DRAWING:

 Levels used:

         1         2         3         4
 12345678901234567890123456789012345678901
 xxxxx.......xxx.....................xx...  40
 .........................................  80
 ........................xxx..............  120
 .........................................  160
 ......xx.......................x........  200
 ...............xxx.......................  240
 ........xx  250

 Plotter pens used:

 xxx.....

 Press [RETURN] to continue.
```

The program will then search through the drawing and mark the levels and plotter pens that were used with an 'x'. In the example above, the program found that the following levels were used: 1,2,3,4,5,13,14,15,36,37,106,107,108,
167, 168,192,216,217,218,249,250. Also, the following plotter pens were used: 1,2,3.

The large matrix of dots represents all the possible levels (1...250). As the program finds an object on a particular level, it replaces the appropriate matrix dot with an 'x'. Thus, an 'x' at a particular location on the matrix indicates that the drawing contains at least one object on that level. The matrix consists of six rows of 40 levels and one row of 10 levels. this arrangement was made to accomodate a 40 column display.

The short row of dots represents all possible pen numbers (1...8). As the program finds an object that uses a particular pen number, it replaces the appropriate dot with an 'x'. Thus, as before, an 'x' instead of a dot indicates that the drawing contains at least one object that uses that pen.

3.16.6 MEASURE

The MEASURE option allows you to measure the distance, angle and area between any two arbitrary points on your drawing.

When this option is selected, the program will ask that you define the first point on your drawing. To do this, move the cursor to the desired point and press the cursor button. Next, the program will ask that you define the second point on your drawing. Once again, move the cursor to the desired point and press the cursor button. After both points have been defined, the program will display the following information:

```
MEASURE:

first point    X:  2.0000     Y:   6.5000
second point   X:  8.0000     Y:  12.0000
change         X:  6.0000     Y:   5.5000
length:            8.1394
rotation:         42.5104
area:             33.0000

Totals:
 area:             0.0000
 perimeter:        0.0000

   [A] Add to totals
   [S] Subtract from totals
   [Z] Zero totals
   [Q] Quit
   [?] help
```

Again, it is important that you remember the following points:

1. All corrdinate points displayed and measurements made are expressed in 'real world coordinates'.

2. Rotation is always expressed in degrees and measured counter-clockwise from the horizontal axis.

The MEASURE menu options available are:

'A' : Causes the program to add the current area and length to the totals field.
'S' : Causes the program to subtract the current area and length from the totals field.
'Z' : Causes the program to clear (zero) the totals field.
'Q' : Causes the program to leave the MEASURE option and return to the INQUIRE menu.
'M' : Allows you to enter two arbitrary points on the drawing and display the distance, angle, and area measurements.

3.16.7 DRIVE

The DRIVE option allows you to override the default data drive number specified in the ENVIRO program. When the DRIVE option is selected, the program will respond with:

Enter the new default data drive #

Type one of the appropriate drive numbers: 4,5,9,10,11,12. For example, if the drive number was set to #5 by the ENVIRO program and you need to inquire about a drawing on drive #9, then change the drive number to #9 using this option. This change will remain in effect as long as you are running the 2D program. The next time you use the program, the drive number will return to the value specified by the ENVIRO program.

3.16.8 WHAT

The WHAT option displays the current default data drive number. When this option is selected, the program will display a message similar to the following:

Default data drive is: #9

You can use this option in order to verify that you are indeed searching for your drawing file on the correct drive number.

3.16.9 SKETCH

Refer to section 3.19 of this manual for a description of the sKetch option.

3.16.10 QUIT

The QUIT option allows you to leave the INQUIRE menu and return to the MAIN MENU.

3.17 INPUT

3.17.1 FUNCTION SELECTION

The INPUT option can be selected by choosing the 'I' character from the 2D program MAIN MENU.

The INPUT menu looks like this:

```
INPUT:
 [D] Digitizer
 [J] Joystick
 [Q] Quit
 [?] help
```

3.17.2 PURPOSE

The INPUT option allows you to change the graphics input device used with the 2D system.

3.17.3 DATA ENTRY

Selection of any option from the INPUT menu will change the current device used for graphics input. The program will always confirm your new input device with the message:

Graphics input device: <input device name>

3.17.4 DIGITIZER

The DIGITIZER option tells the program that you will be using the digitizer as your graphics input device.

Normally, the digitizer used with the program is the Houston Instruments Hipad 11" x 11" digitizer (model DT-11). Notice the four red colored lamp buttons located on the lower left hand corner of the HIPAD. To reset the HIPAD and prepare it for use, press the 'RESET' button. Now press the 'STREAM' button. The 'STREAM' button must always be lit while operating the 2D program.

Two special keys used throughout the program in conjunction with the digitizer in order to increase its accuracy are:

Function key '#' - This key resets the digitizer scaling. When pressed, the cursor will be allowed to track the digitizer's movement across the entire screen.

Function key '$' - This is the digitizer scaler. When pressed, the movement of the cursor is restricted to 1/4 of the screen area presently accessible. This key can be pressed again and again until the cursor has been placed on the desired screen dot.

3.17.5 JOYSTICK

The CADAPPLE program will accept input from an X-Y joystick or game paddles. Using these devices proves very economical, but their accuracy is not as good as the digitizer's.

Two special keys used throughout the program in conjunction with the joystick in order to increase its accuracy are:

Function key '#' - This key resets the joystick scaling. When pressed, the cursor will be allowed to track the joystick's movement across the entire screen.

Function key '$' - This is the joystick scaler. When pressed, the movement of the cursor is restricted to 1/4 of the screen area presently accessible. This key can be pressed again and again until the cursor has been placed on the desired screen dot..

3.17.6 QUIT

The QUIT option allows you to exit the INPUT menu and return to the 2D program MAIN MENU.

3.18 OUTPUT

3.18.1 FUNCTION SELECTION

The OUTPUT option can be selected by choosing the 'O' character from the 2D program MAIN MENU.

The OUTPUT menu looks like this:

```
OUTPUT:
 [P] Plotter
 [R] pRinter
 [S] Specs
 [D] Delete
 [W] What
 [L] List
 [K] sKetch
 [Q] Quit
 [?] help
```

3.18.2 PURPOSE

The OUTPUT option allows you to produce a hard copy of your current drawing. The hard copy can be sent to either a plotter or a graphics printer. Using 'plotter specs', you can define exactly what part of the drawing will be placed where on the plotter and to what scale.

3.18.3 PLOTTER

The PLOTTER option allows you to draw any portion of the current drawing on a graphics plotter.

Exactly how the drawing is drawn on the plotter is defined by a 'plotter specs'. There are 2 types of plotter specs, the default specs and user defined specs. The default plotter specs maps the current screen window (i.e., calculates a default scaling factor) onto the total surface area of the plotter.

The user defined plotter specs maps the current drawing onto the plotter in any way that the user defines. While more complicated than the default specs, the user defined plotter specs is much more powerful. The user defined plotter specs is created using the SPECS option of the OUTPUT menu.

When this option is selected, the program will display the following message:

```
[SPACE] changes, [RETURN] accepts
Velocity (inches per second):
```

The program will display a default velocity in inches per second. If this is not the desired velocity, then simply type the [SPACE] key to change the velocity. When the correct velocity is shown, type the [RETURN] key to accept and continue. The program will then respond with:

```
Enter the name of the desired plot specs
([RETURN] for default)?
```

Type in the name of any previously defined plotter specs and the program will begin plotting using these specs. If you desire to use the default plot specs, then simply press only the [RETURN] key. The program will then output the following message:

```
Place the paper on the plotter.
[RETURN] continues, [ESC] aborts.
```

The program is making sure that you have paper on the plotter. When you are ready to continue, press the [RETURN] key. If at any time the plot needs to be discontinued, then simply press the [ESC] key.

3.18.4 PRINTER

The PRINTER option allows you to print the current screen image on a dot-matrix printer.

This option provides you with the opportunity to obtain inexpensive high quality output from a graphics printer. The 2D program requires a specific hardware configuration in order to successfully produce a screen image print. The following list details these requirements:

1) A GRAPPLER intelligent interface card must be installed in slot #1.
2) A cable must connect the GRAPPLER to the printer.
3) The printer must be supported by the GRAPPLER card.
4) The printer must have a graphics option.

Note that this is a low resolution form of graphics output. Also, the program prints exactly what is on the screen without interpretations.

When this option is selected the program will display the following screen:

```
PRINTER:

  Enter desired features below:

    Double size:  No
    Rotated:      No
    Inverse:      No
    Emphasized:   No

  [RETURN] for no change,
  [ESC] to abort
```

The program will position you to enter the first feature. You are required to define each of the above four features. Type a 'Y' (for Yes) if you want to use this feature. Or, type a 'N' (for No) if you do not. If you type only the [RETURN] key, then the program will assume a 'No' response. Type the [ESC] key if you want to abort this option.

Once you have setup all of the features, the program will output the following message:

```
Align the paper in the printer.
Type [RETURN] to continue.
```

At this time, align the paper in the printer and type the [RETURN] key. The program will output the following message:

```
Please wait while the graphics image
is being sent to the printer.
```

The program will now output the screen image to the graphics printer. When the print is completed, the program will display the OUTPUT menu.

3.18.5 SPECS

The SPECS option allows you to define your own 'plotter specs'. Plotter specs are used to determine exactly what part of a drawing will be placed where on the plotter, and to what scale.

The plotter specs can be thought of as defining a mapping function that determines how the objects in the real world coordinate system of the drawing are to be placed on the limited coordinate system of the plotting surface.

The mapping formula is:

(real world coordinate limits) * (scaling factor) =
(plotter coordinate limits)

For short, we will call the 'real world coordinate limits' the 'screen window' and the 'plotter coordinate limits' the 'plot limits'.

By assigning values to any two of the three factors in the mapping function, the third factor can be computed automatically. This is exactly what is done when defining plotter specs.

When you select this option the program will ask you to name the plotter specs that you want to define. Type in a name of up to seven characters. Terminate your entry with a [RETURN]. You will then be given three choices of how to define the plotter specs:

A. You enter the plot limits and the screen window. The computer determines the correct scale to use.

B. You enter the screen window and the scale and shift on the plotter. The computer determines the plot limits.

C. You enter the plot limits and the scale. The computer determines the size of the screen window, but allows you to move it around.

A more detailed explanation of each choice follows:

A. The machine will ask you to type in the plot limits. You should type in the limits on the surface of the plotter where you want the drawing to be placed. For example, you might want your drawing to be plotted in a 3x3 inch section of the plotting surface.

Next, the machine will ask you to define one corner of the screen window using the cursor. Once you do this the machine will display a blinking screen window. This window is in the same proportions as the plot limits that you entered. Moving the cursor will change the size of the screen window. When you are happy with the screen window, accept it and the machine will automatically calculate the scaling and save the plotter specs.

B. The machine will ask you to define one corner of the screen window using the cursor. Once you do this the machine will display a blinking screen window. Moving the cursor will change the size of the screen window. This window can be made to any proportion. When you are happy with the screen window, accept it.

Next, the machine will ask you for the scaling factor. Type in an appropriate number. Finally, the machine will ask for the X and Y plotter shifts to be applied when plotting. Again type in an appropriate number. The machine will automatically calculate the plot limits and save the plotter specs.

C. The machine will ask you to type in the plot limits. You should type in the limits on the surface of the plotter where you want the drawing to be placed.

Next, the machine will ask you for the scaling factor. Type in an appropriate number. Once you do this the machine will display a blinking screen window. The size of this window has been automatically determined by the plot limits and scale that you just entered. Moving the cursor will move the window around on the screen. When you are happy with the location of the screen window, accept it and the machine will save the plotter specs.

3.18.6 DELETE

The DELETE option allows you to delete any previously defined plotter specs.

When you select this option the program will ask:

Delete what plot specs ?

You should type in the name of the plotter specs that you wish to delete. Terminate your entry with a [RETURN]. If the plot specs exists, then the program will then ask:

Proceed with Delete (Y/N) ?

A 'Y' response will continue to delete the plot specs. Any other response will abort the operation.

3.18.7 WHAT

The WHAT option displays all the information contained in a selected plotter specs.

When you select this option the program will ask:

Show what plot specs ?

Enter the plotter specs name and press the [RETURN]. If the plot specs exists, then the program will display three pieces of information:

1. The screen window that is to be mapped onto the plotting surface will be shown as a blinking rectangle.

2. The limits of the plotting surface onto which the screen window will be mapped.

3. The scaling factor that will be applied when the screen window is mapped onto the plotting surface.

Once the machine displays this information, it will ask:

Leave window on screen ?

If you want the blinking window to remain on the screen, type a 'Y', otherwise type a 'N'. It is sometimes useful to leave the window displayed if you are about to define another window and want to know where a previous window was located.

3.18.8 LIST

The LIST option allows you to list all of the plot specs that you have saved in your workfile.

3.18.9 SKETCH

Refer to section 3.19 of this manual for a description of the SKETCH option.

3.18.10 QUIT

The QUIT option allows you to exit the OUTPUT menu and return to the 2D program MAIN MENU.

3.19 SKETCH

Sometimes selective erasures, moves and the like leave imperfect images on the screen. The SKETCH option allows you to clear the graphics screen, and redraw the picture to eliminate any imperfections in the graphics image that might have appeared while modifying the screen image.

The 2D program implements algorithms that will not display objects or text that lie off the viewing surface. Therefore, no objects or text may be accessed if they do not appear on the screen.

While the program is redrawing the objects on the screen, you can press the [ESC] key. This causes the SKETCH process to halt leaving the objects already drawn on the screen intact. All other objects that would have appeared on the screen had the [ESC] key not been pressed, are no longer accessible. To get at these undrawn objects select the REDRAW option from the WINDOW menu and the program will redraw the entire workfile.

3.20 EXIT

The EXIT option allows you to leave the 2D drafting program and return to the APPLE Pascal main menu.

The program will output a warning message. This message provides you with the opportunity to abort the EXIT option. You should be sure to save your drawing on the disk using the SAVE option on the FILER menu. If you still want to quit, then type the 'Y' key. Any other response will abort the operation.

SECTION 4.0 CUSTOMER INFORMATION

4.1 HARDWARE WARRANTY

All turnkey systems are warranted against defects in workmanship and material under normal and proper use in their unmodified condition for a period of ninety (90) days from date of initial shipment for new systems and thirty (30) days from date of shipment for used systems. As a condition of this warranty, customer must (i) notify T & W SYSTEMS in writing of its claim, (ii) ship the product (or subassembly) to the designated T & W SYSTEMS repair depot, transportation prepaid, and (iii) include with the returned products (or subassembly) a written description of the claimed defects. Transportation charges for the return to customer shall be paid by T & W SYSTEMS within the fifty (50) United States, District of Columbia and Canada. This warranty outside of this designated area is exclusive of costs of shipping, customs clearance and other related charges.

If T & W SYSTEMS determines that the products returned to it for warranty correction are not defective as herein defined, customer shall pay T & W SYSTEMS all costs of handling and transportation. All repaired or replaced products shall be returned only to customer and not to third parties to whom customer may have sold, leased or otherwise transferred the products. The warranties provided are exclusive to the customer only.

T & W SYSTEMS' sole responsibility under the above warranties shall be, at its option, to either repair or replace any products and/or components which fail during the warranty period due to defects in workmanship and material, provided customer has promptly reported same to T & W SYSTEMS in writing and T & W SYSTEMS has upon inspection found such products and/or components to be defective. All replaced products shall become T & W SYSTEMS' property.

T & W SYSTEMS SHALL HAVE NO LIABILITY FOR SPECIAL, INCIDENTAL, COLLATERAL OR CONSEQUENTIAL DAMAGES OR INJURY TO PERSONS OR PROPERTY OF ANY KIND FROM ANY CAUSE ARISING OUT OF THE SALE, INSTALLATION OR USE OF ITS PRODUCTS.

EXCEPT FOR THE EXPRESS WARRANTIES STATED ABOVE, T & W SYSTEMS DISCLAIMS ALL WARRANTIES ON PRODUCTS INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS: and the stated express warranties are in lieu of all obligations or liabilities on the part of T & W SYSTEMS.

4.2 SOFTWARE WARRANTY

Software is warranted during the ninety (90) day period following delivery to conform to the T & W SYSTEMS software product description (user's manual) applicable at the time of order. T & W SYSTEMS' sole obligation hereunder shall be to remedy any nonconformance of the software to such description.

T & W SYSTEMS SHALL HAVE NO LIABILITY FOR SPECIAL, INCIDENTAL, COLLATERAL OR CONSEQUENTIAL DAMAGES OR INJURY TO PERSONS OR PROPERTY OF ANY KIND FROM ANY CAUSE ARISING OUT OF THE SALE, INSTALLATION OR USE OF ITS PRODUCTS.

EXCEPT FOR THE EXPRESS WARRANTY STATED ABOVE, T & W SYSTEMS DISCLAIMS ALL WARRANTIES OF MERCHANTABILITY AND FITNESS: and the stated express warranties are in lieu of all obligations or liabilities on the part of T & W SYSTEMS.

4.3 CUSTOMER COMMENTS AND SUGGESTIONS

T & W SYSTEMS is committed to providing software systems that are reliable, powerful and yet easy to use and understand. We value any customer comments that will help us to further improve our products. Please use the forms printed on the following pages to write down any comments or suggestions that you might have. We will read them all and use them as a basis for future revisions of our software products.

CUSTOMER COMMENT FORM

Company or Institution_____

Your name_____

Address_____

Department_____

City, State, Zip_____

Your current software and its version number_____

Your comments and suggestions_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Please send this form to:

T & W Systems, Inc.
Software Development Department
7372 Prince Drive #106
Huntington Beach, CA 92647

4.4 SOFTWARE PROBLEMS

Despite our best efforts, our software isn't always perfect. If your software behaves incorrectly, it could have what is lovingly referred to as a 'bug' in it. Use the form printed on the next page to report any bugs directly to T & W Systems.

SOFTWARE PROBLEM FORM

Company or Institution_____

Your name_____

Address_____

Department_____

City, State, Zip_____

Your current software and its version number_____

Please describe the problem in as much detail as possible. Be sure to include:

1. What menu level and option you were at when the problem occured.
2. Exactly what action seemed to provoke the bug.
3. Any unusual actions on your part prior to the problem.
4. Anything else that seems unusual or important to you.

The more details you provide us, the quicker we can find and fix the problem. Thanks!

_____

_____

_____

_____

_____

_____

_____

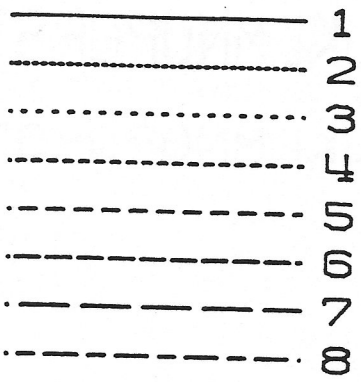
Please send this form to:

T & W Systems, Inc.
Software Maintenance Department
7372 Prince Drive #106
Huntington Beach, CA 92647

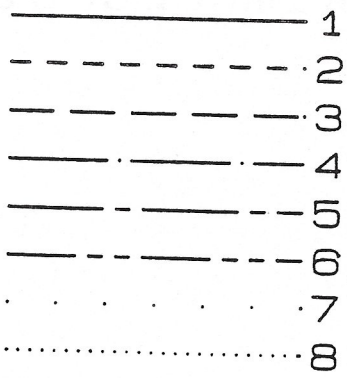
SECTION 5.0 APPENDIX

5.1 TYPES OF LINESTYLES

The Houston Instrument DMP-29 plotter (as well as all DM/PL plotters) supports several linestyle patterns. Below is a plot of the linestyles available along with their associated numbers.

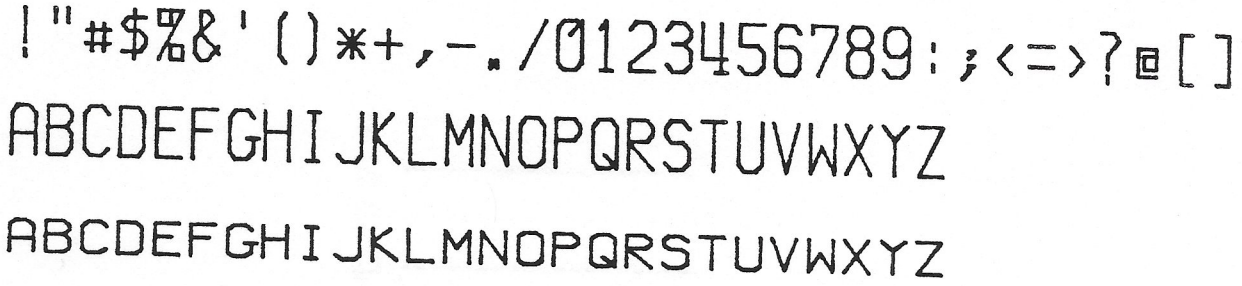


The Hewlett Packard 7470A plotter (as well as all HP-GL plotters) supports several linestyle patterns. Below is a plot of the linestyles available along with their associated numbers.

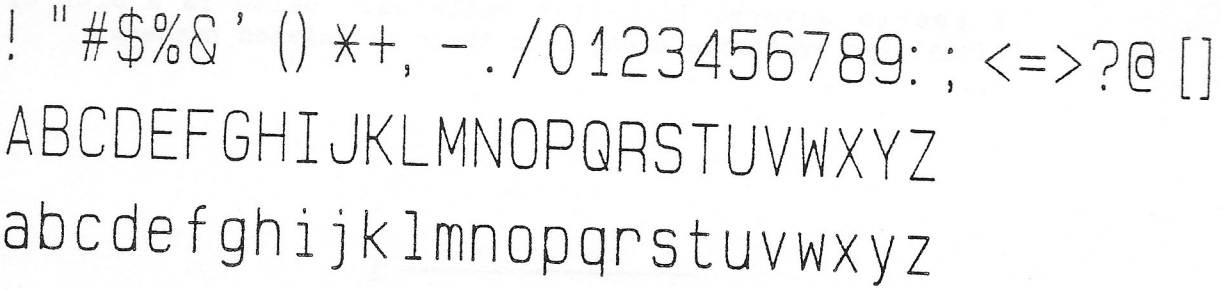


5.2 CHARACTER SETS

The Houston Instruments, Iwatsu and Tektronix plotters will use the following character set:



The Hewlett Packard plotter will use the following character set:



CADAPPLE

2D DRAFTING SYSTEM

ENVIRO USER'S MANUAL

RELEASE 3.0

JANUARY 1984

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1.0 PURPOSE

The 2D program can communicate with many different peripheral devices such as plotters, digitizers and joysticks. Each of these devices is connected to an interface located inside the computer. You must tell the 2D program the devices that are being used as well as their corresponding interface. In addition, there are default run-time conditions that you must define before you can use the 2D drafting program. You can do this by using the ENVIRO30 program described in this manual.

The copy of the 2D program master 'boot' diskette that you should have made by this time has a program on it called 'ENVIRO30'. This program is used to define the various default run-time conditions. Follow the instructions in this manual in order to make these changes.

2.0 FUNCTION SELECTION

The ENVIRO30 program is very easy to use. The steps below outline how to get this program up and running:

1. Turn off your computer.

2. Insert a copy of the 2D 'boot' diskette into drive #4 (that's drive #1 for those familiar with DOS).

3. Turn on your computer.

4. Within a few seconds, the computer will display the Pascal operating system main menu.

5. Press the 'X' key to select the EXECUTE option off the Pascal main menu. The computer will display the following message:

   Execute what file?

6. Type the program name 'ENVIRO3Ø' and press the [RETURN] key. Within a few seconds, you will see the following environment menu with the default run-time conditions displayed on the screen.

DID NOT WORK -

NO FILE 'ENVIRO30'.CODE

```
ENVIRONMENT MENU1:   version 3.0

[W] Workfile size in objects:  1128

[I] Input:  Digitizer

[O] Output configuration:
  interface:    CCS 7710-01        slot #2
  plotter:      HI DMP-40
  right limit:  15.0000 inches
  top limit:    9.2500 inches

[B] Booster:        No               slot #
[M] two Monitors:   No
[D] two Drives:     Yes

[A] Alternate menu
[Q] Quit
[ESC] Aborts all changes
```

The following menu is the alternate environment menu. You can see this menu by pressing the 'A' key to select the ALTERNATE option.

```
ENVIRONMENT MENU2:   version 3.0

[F] File volumes:
     2D30.CODE:         #5
     2D30.WRK.DATA:     #4
     MENU30.DATA:       #4
     MESS30.DATA:       #4
     HELP30.DATA:       #5
     PSTROKES30.DATA:   #5
     SSTROKES30.DATA:   #5
     HATCH30.DATA:      #4
     LIB30.DATA:        #4
     DRAWING FILES:     #5
     LIBRARY FILES:     #5

[A] Alternate menu
[Q] Quit
[ESC] Aborts all changes
```

3.0 DATA ENTRY

You will notice at the top of the screen a menu title labeled 'ENVIROMENT MENU1: version 3.0'. Below this title is the list of options which can be selected by typing the letter between the '[' and ']' characters. As mentioned before, there are two environment menus. To view or change the other environment menu, press the 'A' key to select the ALTERNATE option. The other menu will be displayed.

When an option is selected, one of two different methods are used to enter information. The first method requires that you type in a value followed by pressing the [RETURN] key. Some examples of this method are: the workfile size, the plotter limits and the file volumes options. The second method requires that you simply press the [SPACE] bar in order to 'cycle' through the various options. When the proper configuration is displayed, simply press the [RETURN] key to accept it. Some examples of this method are: the input, the output, the slot number, the booster, the two monitors and and the two drives options.

An example of the first method: to change the workfile size, you must press the 'W' key. after pressing the 'W' key, the program will move the cursor to the line labeled 'Workfile size in objects' and it will wait for you to type in the new workfile size followed by the [RETURN] key.

An example of the second method: to change the input device, you must press the 'I' key. After pressing the 'I' key, the program will move the cursor to the line labeled 'Input' and will wait for you to press the [SPACE] bar to change the current configuration. Each time you press the [SPACE] bar, the program displays a new configuration. When the desired configuration is displayed, accept it by pressing the [RETURN] key.

Notice that whenever an option is selected, the program will display a helpful message at the bottom of the screen instructing you on how to enter the new default run-time condition and the type of information that is expected.

Selecting the QUIT option off the environment menu will save all of the changes that you have just made to the default run-time conditions.

Selecting the [ESC] option off the environment menu will abort the ENVIRO30 program without saving any changes you might have just made and return you to the Pascal operating system main menu.

4.0 USE OF COMMANDS

4.1 WORKFILE SIZE

The WORKFILE SIZE option allows you to change the default size of the workfile used by the 2D program.

When this option is selected, the program will position you on the menu line labeled 'Workfile size in objects'. Type the number of objects that you need space for and press the [RETURN] key. An integer value is expected and it will be rounded up to the nearest multiple of 24. The maximum number of objects that are allowed by 2D program is about 4000. If you are using two standard disk drives, then the maximum number of objects that are allowed is about 1100 (this restriction is due to disk density).

This field is used to setup the size of the workfile used by the 2D program. The size of the workfile is in units of objects. All objects, except for text, require one unit of space or one record. Text requires up to two units or two records. Normally, you should only change this field if the 2D program displays the following message:

'no more room, resize workfile.'

WARNING: if the workfile size is changed, then all chances for recovering the drawing in the workfile are gone. In other words, all information in the workfile is lost.

4.2 INPUT

The INPUT option allows you to change the default graphics input device used by the 2D program.

When this option is selected, the program will position you on the menu line labeled 'Input'. Press the [SPACE] bar until the desired graphics input device is displayed. Press the [RETURN] key to accept the new graphics input device. The choices available are: the 'joystick' or the 'digitizer'.

The next time you run the 2D program, the default graphics input device will be set to the device specified by this field.

4.3 OUTPUT

The OUTPUT option allows you to change the following default run-time conditions: the plotter interface card, the type of plotter being used and the plotter's active plotting limits.

When this option is selected, the program will position you on the menu line labeled 'interface'. Press the [SPACE] bar until the desired asynchronous serial interface is displayed. Press the [RETURN] key to accept the new interface card. The following choices are available: the 'CCS 7710-01 card' or the 'Apple Super Serial card'. Once the type of plotter interface card has been specified, the progrm will position you to enter the slot number that the card resides in. Press the [SPACE] bar until the desired slot number is displayed. Press the [RETURN] key to accept the new slot number. The choices avialable are: slots 0 through 7.

Next, the program will position you on the menu line labeled 'plotter'. Press the [SPACE] bar until the desired plotter type is displayed. Each time the plotter type is changed, the program will update the plotter's right and top plotting limits. These limits define the active plotting area. Press the [RETURN] key to accept the plotter type. The following choices are available: HP 7470A, HP 7475A, HP 7580A/B, HP 7585A/B, HI DMP-3&4, HI DMP-6&7, HI DMP-29, HI DMP-40, HI DMP-41, HI DMP-42, Tektronix 4662, Iwatsu SR-6602.

Next, the program will position you on the menu line labeled 'right limit'. Type the right plotter limit (in inches) and press the [RETURN] key. Note that the program has already displayed the right limit that matches the type of plotter that you have just selected. However, if you need to override this default limit, then you may do so. The left plotter limit is assumed to be zero. You may type the limit as a floating point number such as 14.75 or 24.5 inches.

Next, the program will position you on the menu line labeled 'top limit'. Type the top plotter limit (in inches) and press the [RETURN] key. Note that the program has already displayed the top limit that matches the type of plotter that you have just selected. However, if you need to override this default limit, then you may do so. The bottom plotter limit is assumed to be zero. You may type the limit as a floating point number such as 14.75 or 24.5 inches.

The plot limits that you have just defined above are the actual physical limits of the plotter and not just the dimensions of the plotter paper. Your plotter's plotting surface limits are described in your plotter's reference manual. It is important to note that the plotter limits are not necessarily the same as the size of paper it can hold. For example, the Houston Instruments DMP-29 8 pen plotter handles 11" x 17" paper but its actual plotting area is only 10" x 15".

The following list provides the plotter limits (in inches) of all the plotters supported by the 2D program:

Hewlett Packard:	right limit	top limit
HP 7470A	the right program will ask	
HP 7475A	the plotter to send	
HP7580A/B	its right and top limits	
HP7585A/B	to the program.	
Houston Instruments:		
DMP-3 & 4	8.5000	7.2500
DMP-6 & 7	14.0000	9.7500
DMP-29	15.0000 (10.00)	10.0000 (7.25)
DMP-40	15.0000 (9.25)	9.2500 (7.00)
DMP-41	32.0000 (20.00)	20.0000 (15.00)
DMP-42	34.0000 (21.50)	21.2500 (14.50)
Tektronix:		
4662	15.0000	10.0000
Iwatsu:		
SR-6602	14.3700	9.62000

Note that the 2D program does not need to know the limits of any of the Hewlett Packard line of plotters. This is because the program will ask the plotter to send its limits back to the program. Also, note that in the case of the Houston Instruments line of potters, the numbers in parenthesis indicate the plotter's small chart limits.

You will notice that the label on the 'code' disk provided with your 2D system indicates the type of plotter that is to be used with the system. It is very important that the 'plotter' field be defined the same as the label on the 'code' disk. Otherwise, the 2D program will not be able to communicate properly with your plotter. If the label on your 'code' disk does not match your plotter, then contact your representative for the correct 'code' disk. The following table lists the type of plotters that a specific 'code' disk will support:

'code' disk	plotters supported
DM/PL	HI DMP-3&4, HI DMP-6&7
DM/PL+	HI DMP-29, HI DMP-40, HI DMP-41, HI DMP-42
HP-GL	old HP 7470A (serial number prefix lower than 2308A)
HP-GL+	new HP 7470A, HP 7475A, HP 7580A/B, HP 7585A/B
TEK	Tektronix 4662
IWATSU	Iwatsu SR-6602

4.4 BOOSTER

The BOOSTER option allows you to tell the 2D program that you are using the ACCELERATOR][booster card to increase the computer's processing power.

When this option is selected, the program will position you on the menu line labeled 'Booster'. Press the [SPACE] bar until the desired state of the field is displayed. Press the [RETURN] key to accept the new booster card state. The choices available are: 'Yes', there is a booster installed and 'No', there is not a booster card installed.

If the BOOSTER field is set to 'Yes', then the program will position you to enter the slot number that the card resides in. Press the [SPACE] bar until the desired slot number is displayed. Press the [RETURN] key to accept the new slot number. The choices available are: slots 0 through 7.

Note that the BOOSTER option is to be set to 'Yes' only if you are using an ACCELERATOR][booster card. The next time you run the 2D program, the program will recognize the ACCELERATOR][card.

4.5 TWO MONITORS

The TWO MONITORS option allows you to tell the 2D program that you are using two monitors, one for graphics/coordinate dial and one for menus/messages.

When this option is selected, the program will position you on the menu line labeled 'two Monitors'. Press the [SPACE] bar until the desired state of the field is displayed. Press the [RETURN] key to accept this state. The choices available are: 'Yes', there are two monitors installed and 'No', there are not two monitors installed.

If the TWO MONITORS field is set to 'Yes', then the next time you run the 2D program it will respond differently when the 'screen' function key is pressed. That is, there will only be two screen display modes for the graphics/coordinate monitor: all graphics and mixed graphics and text. The third display mode (all text) is always present on the second monitor (the one for menus/messages).

4.6 TWO DRIVE

The TWO DRIVES option allows you to tell the 2D program that you are using only two standard 5 1/4" 140K byte floppy disk drives.

When this option is selected, the program will position you on the menu line labeled 'two Drives'. Press the [SPACE] bar until the desired state of the field is displayed. Press the [RETURN] key to accept this state. The choices available are: 'Yes', there are two drives installed and 'No', there are not two drives installed.

If the TWO DRIVES field is set to 'YES', then the next time you run the 2D program it will require that you remove the 'boot' disk from drive #4 and replace it with the 'work' disk. This process is required in order to run under a standard two drive configuration.

4.7 FILE VOLUMES

The FILE VOLUMES option allows you to specify the Pascal volume (normally a floppy disk) for each and every 2D program codefile and datafile.

When this option is selected, the program will position you on the menu line labeled '2D30.CODE'. Type the volume number that the file '2D30.CODE' will reside on when the 2D program is used and press the [RETURN] key. An integer value is expected within the following range: 4,5,9,10,11,12. Next, the program will position you on the next field. Once again type the volume number and press the [RETURN] key. Continue this process for each and every codefile and datafile.

As stated before, each and every file used by the 2D program must have its volume number specified. There is only one exception: the file 'ENVIRO30.DATA' must ALWAYS be on volume #4.

When you were shipped your 2D system, it was configured for two standard 5 1/4" 140K byte floppy disk drives. For example, '2D30.CODE', 'PSTROKES30.DATA', and other files are located on volume #5, and '2D.WRK30.DATA', 'MESS30.DATA', and other files are located on volume #4. If for any reason these files need to be located elsewhere, then be sure to update their new location by using this option.

If you have a hard disk, a ramdisk or higher density floppy disks that will allow a different configuration, then this option can help you take advantage of those hardware features.

4.8 ALTERNATE MENU

The ALTERNATE option allows you to display the other environment menu. Simply press the 'A' key and it will be displayed.

4.9 QUIT

The QUIT option allows you to exit the ENVIR030 program and make permanent all of the changes just entered. You will be returned to the Pascal operating system main menu.

4.10 [ESC]

The [ESC] option allows you to exit and abort the ENVIR030 program. Any and all changes just entered WILL NOT be saved. You will be returned to the Pascal operating system main menu.

APPLICATION NOTES

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Application note: Introduction

T & W Systems' General Purpose Drafting System is documented in several parts:
Installation Manual
Designer's Reference Manual
Enviro Manual
Application Notes

The Installation and Enviro manuals guide the startup of the drafting system. The Designer's Reference manual provides details of how to use the commands and functions of the drafting system in order to make professional drawings in any discipline such as architecture, machine design, electrical and other schematics. These are found in another section of this volume, see the tabs.

This "Application Notes" section of the manual is devoted to short descriptions of how features of the drafting system may be used for a specific application and also includes "helpful hints" which have been contributed by users of the drafting package. This section is necessarily kept informal and users of the drafting system are encouraged to submit further ideas on how they use the system so those ideas may be incorporated.

Updates will be added to this section from time to time as they become available.

INTRODUCTION

These notes provide an introduction to the use of the 2D Drafting System. They are divided into a series of exercises to include adding items to the drawing, modifying the drawing, manipulating groups of drawing components, switching levels, and plotting the drawing. This material has been written primarily for those unfamiliar with the features of the 2D Drafting System but it assumes that the user is already familiar with drafting principals for his application.

This tutorial has frequent references to the Designer's Reference Manual. The Designer's Reference Manual was written expressly for each computer and contains specific information appropriate for that computer.

This training outline can serve as a tutorial for self-instruction or as an instructor's outline for a 12-16 hour hands-on training class.

The outline is based on actual experience of training several classes. If followed, it will introduce students to the CAD system in an orderly manner progressing from simple to complex concepts. When the student has completed this work, the student will have been through each command twice and will have produced an example drawing from schematics, mechanical drafting and architectural drafting.

GENERAL CONCEPTS

The 2D Drafting System is built around a series of menus. The MAIN menu is the access point to the various features of the system.

To create the drawing, you 'add' objects from the list of objects on the ADD menu. Circles, lines, rectangles, arcs, ellipses, polygons, and text are all simple objects that may be used to create the drawing.

As a drawing is created, it is frequently necessary to make modifications to the objects already on the screen. A large number of options are provided on the MODIFY and GROUP menus to make these modifications quick and easy. These options include 'Copy', 'Move', 'Scale' (make larger or smaller), 'Delete', etc. Individual objects are modified using the options on the MODIFY menu. Groups of objects are modified using the options on the GROUP menu.

All objects have 'properties'. Each object is created with a specific linestyle (solid, dotted or dashed line), pen number, color, etc. The complete list of properties is listed under 'Object Properties' in the MODIFY section of the Designer's Reference Manual. Since each object on the drawing must have these properties specified, the program will automatically assign standard properties which will be given to all objects in the drawing unless you change them. This helps the beginning user to start making drawings quickly and easily without having to worry about many minor options.

GETTING STARTED

If you have already set up your computer system and copied your Master diskette, you already have experience in booting the system, handling the diskettes, selecting options from a menu and executing a program. If your system was already assembled, you should read the first section of your Designer's Reference Manual describing the procedures for booting the system and running the 2D Drafting System because these procedures are specific for the computer. These skills are used continuously in using the 2D Drafting System so a brief review is appropriate.

To run the CADAPPLE system:

Insert the Copy of the 'Boot' diskette in drive #4 (drive labeled #1).
Insert the Copy of the 'Code' diskette in drive #5 (drive labeled #2).
Boot the system by turning on the power. The name of the computer will be displayed, followed by the system identification notice, then the Pascal Command menu.

Press 'X' (execute) #5:2D30 [RETURN].

To run the VersaCAD-IBM system:

Insert the Copy of the 'Boot' diskette in drive #4 (drive on the left).
Boot the system by turning on the power. The operating system identification notice is displayed; then the System menu.

Press 'V' to execute the VersaCAD program.

If you have a problem either booting the system or executing the 2D program, refer to the Problems and Solutions section of the Application Notes.

About Menus and Messages

A menu is a list of available choices. Most options in the 2D Drafting System are displayed as menu options on the screen. One letter of each option is upper case. To select an option, just press its upper case letter on the keyboard. Once in a while, after selecting a command, the computer will wait for you to type in something. Here's something you need to remember about that: If the answer to the computer's question takes more than one letter, you need to press the [RETURN] key to tell the computer when you have entered the last letter. If the answer to the computer's question always takes only one letter, then no [RETURN] is necessary. Watch the cursor (blinking object on the menu screen) to see whether it expects more typing or not.

As you select options from the menus and create the drawing, the program will display messges on the menu screen to guide you. Please look at the menu screen for instructions and options as you create the drawing.

A Quick Look

At this point you should be looking at the 2D Drafting System MAIN menu. Before you start on the first exercise, you should take a quick look through the system. You can't hurt the system by using it, so don't be afraid to try things. Think of the screen as a drawing sheet. You add lines and other figures to the sheet from the ADD menu, change the lines and figures from the MODIFY menu, send the drawing to the plotter from the OUTPUT menu and so on. By the way, your Designer's Reference Manual has a page that shows all of the commands and you might find that to be a handy thing to have open beside you as you explore the commands.

If your system is configured correctly, a small crosshairs (cursor) should be displayed on the graphics screen. (On the CADAPPLE system, you can switch between the text and graphics screens using the <shift> <SCREEN> function key.) If you are using a digitizer, move the digitizer puck across the tablet to move the cursor around on the screen. If you are using a joystick, the cursor will follow the movement of the joystick.

You can begin your exploration of the 2D Drafting System by adding a few objects onto the screen. At the MAIN menu, press 'A' (Add). The ADD menu will be displayed. The ADD menu lists all of the primitive graphics objects that the 2D program can create.

All objects are added to the drawing by placing an object's characteristic points. The characteristic points for a rectangle are two opposite corners. The characteristic points for a line are the two endpoints. The digitizer or joystick is used to place an object's characteristic points.

Before you add your first object, be sure that object tracking is on so that you can see the object as you add it. Object tracking is turned on and off using a function key. See your Designer's Reference Manual in the section on 2D Concepts.

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To add a rectangle to the drawing:

1) Press 'R' (Rectangle)
2) Move the cursor to the position on the screen where you want one corner of the rectangle. Press the cursor button on the digitizer or joystick. The first corner is now permanently fixed.
3) Move the cursor to the position on the screen where you want the opposite corner of the rectangle. As you move the cursor, the program will repeatedly draw a rectangle. When you are satisfied with the size and shape of the rectangle, press the cursor button to 'accept' the position. The rectangle is now part of the drawing.

If you make a mistake while adding an object, just leave it for now and continue making objects. Remember, we are just beginning.

To add lines to the drawing:

1) Press 'L' (Line)
2) Move the cursor to the position on the screen where you want the line to start and press the cursor button.
3) Move the cursor to the position on the screen where you want the other end of the line to be. As you move the cursor, the program will repeatedly draw a 'rubberband' line from the first endpoint to the cursor's present position. When you are satisfied with the line, 'accept' it by pressing the cursor button. Another line will be drawn from the end of the first line to the current cursor position.
4) When you are finished making lines, press 'Q' (Quit)

While you were making lines, did you notice the list of options that are available while you are creating lines? You can lock the line to the X or Y axis, cause an arrowhead to appear on one end of the line, erase the last line, and many other options. All the options are listed in the Designer's Reference Manual in the ADD Line section.

Nearly all of the options on the ADD menu work in a similar way. You select the object from the ADD menu, position the first characteristic point then use any of the options displayed by typing the letter of the option. Finally you position the last characteristic point. Each object is a little different and many options are available. Try them.

When you have a few objects on the screen and the ADD menu is displayed, press 'Q' (Quit) to return to the MAIN menu.

With a few objects on the drawing, you can now practice modifying them. At the MAIN menu, press 'M' (Modify). When the MODIFY menu is displayed, notice that one of the objects on the graphics screen is blinking. It is probably the last object that you added.

To modify an object in the MODIFY menu, you must first cause it to blink. That is how the computer lets you know which object it will work on. There are 2 ways to get an object to blink: (1) is to use the '<' and '>' keys to run backward or forward through the list of objects you have entered; (2) is to press 'F' (Find) then move the cursor to touch the object and press the cursor button. To repeat: THE OBJECT YOU WANT TO MODIFY MUST BE BLINKING before you can work on it with one of the commands such as Delete, Move, Copy, etc. Once you have this idea understood, you can use most of the options on the MODIFY menu by following the screen messages.

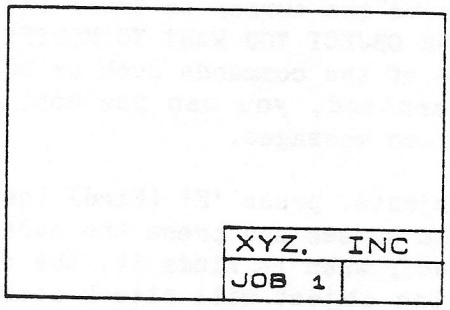
To practice modifying objects, press 'F' (Find) then position the cursor on top of one of the lines on the screen and press the cursor button. The program will search for that object and, when it finds it, the object will blink. Now press 'M' (Move). The blinking object will attach itself to the cursor. Using the digitizer or joystick, you can now move the cursor to a different location on the drawing. When you are satisfied with the new location, press the cursor button and the blinking object will be fixed in its new location. Try some of the other commands on the MODIFY menu such as Copy, Rotate, and Delete.

Don't spend too much time experimenting. The following exercises will answer many questions.

EXERCISE 1. TITLE BLOCK

The first exercise is to draw a border and title block which we can use for our later schematic drawings.

The first step in any drawing is to clear the screen and workfile. At the MAIN menu go to FILER and choose NEW. Answer 'Y' (Yes) when the computer asks, "Are you sure?" Notice the screen is now blank. Leave the FILER by pressing 'Q' for QUIT. Note that this is always how we leave one menu and go back to a previous or higher menu.



Next, go to ADD and draw the border and title block using rectangles, lines and text. From now on, when we want to talk about lines, rectangles, text, circles, etc. we will refer to them as objects. That's just a shorthand way to refer to all those things we draw. If you make a mistake while adding objects, QUIT out of the ADD menu and choose MODIFY. Here you can delete an object or move it on the screen or any of several other operations.

It is important here to understand something about adding objects. If you are in the process of adding an object and you decide you don't wish to complete it, simply press the [ESC] key (escape) and that partially complete object will disappear. You can then re-enter the object. If you have completed the command of adding an object and you want to change it, then you need to leave the ADD menu and go to the MODIFY menu.

When you have finished your border and title block, go to FILER and Save the title block drawing for later use. You will be asked the name of the drawing and you can type in any name containing 1 to 8 letters or numbers. After you have saved the drawing (the message "DRAWING HAS BEEN SAVED" will appear on the screen), you can clear off the screen again by choosing NEW.

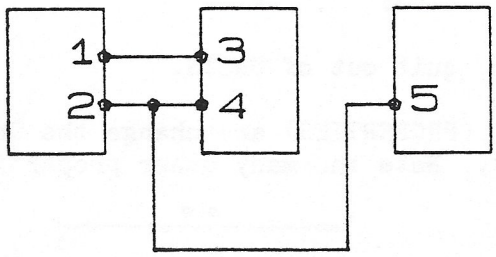
To be real sure that you have saved the drawing, while in FILER, GET the drawing back. If it reappears on the screen, you have proof that it is saved. Clear the screen again by choosing NEW.

EXERCISE 2. SCHEMATIC

Now we will draw a little schematic on the blank screen and then we'll put it on our border-title block and plot it.

Since we have already cleared the screen and workfile, the first step in this exercise is to go to the UNITS menu to set up the grid for the drawing. Press 'U' for UNITS then 'G' for GRID and enter lines at 20 units with 5 divisions. Grids are only guidelines; they never appear on the plotted drawing. Quit out of UNITS (returning to the Main menu). The next step is to go to the PROPERTIES menu and change the Group Name to 'SCH'. This means that each object we add will become a part of the group 'SCH' so we can later move, copy or otherwise work on the whole group. Quit out of PROPERTIES.

Now, go to ADD and draw three simple chips, using rectangles, and interconnectors with text. Draw one of the connectors with a small polygon. Then go to MODIFY and copy it 5 more times:



When you have finished your schematic, go to FILER and GET your title block. The computer will ask you two questions: 'Use the switches, units, properties, windows and plot specs from this new drawing (Y/N)?'. Answer 'Y' although it doesn't really matter in this case. The next question will be: 'Put objects of the drawing into the group 'SCH' (Y/N)?'. Say 'NO' to that. Notice how it draws the border around or merges with your schematic drawing. If you need to move the schematic so it doesn't interfere with the title block, go to GROUP and use the MOVE command. When it asks for the name of the GROUP to be moved, type in 'SCH'[RETURN]. This is why you didn't want to put the title block into group 'SCH' when you got it from the file - you wanted to be able to move the schematic relative to the title block.

Now, at the MAIN menu, go to OUTPUT and choose Plotter. Use the default plot specifications and make your drawing. If your drawing did not turn out as you expected, please refer to the Problems and Solutions section of the Application Notes.

You have now progressed through all of the basics of computer-aided-drafting. You have used the commands to add graphics objects to the workfile. You then 'saved' a workfile.

Note that a workfile and a 'saved' file are like two copies of the same drawing. When you clear the workfile with the NEW command you still have the file you saved. When you GET a file, it is added to the workfile; that's why you clear the workfile first. When you GET a file it puts a copy of the file in the workfile. The GET does not change the saved file.

EXERCISE 3. MECHANICAL DRAFTING

In this exercise, we will use the options in the UNITS menu to set up the screen to the appropriate scale for this next drawing. This exercise also includes the use of automatic dimensioning.

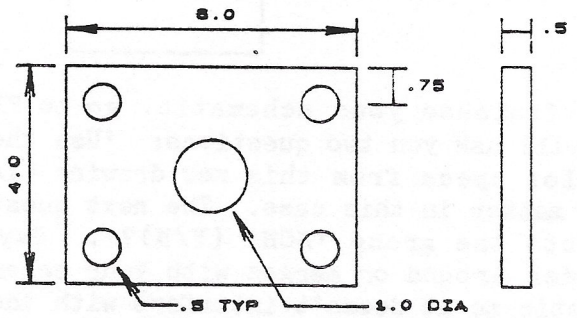
As always, the first step is to clear the screen by going to FILER and choosing 'N' (NEW). Quit out of FILER.

At the MAIN menu, select 'U' (UNITS). On the UNITS screen, select 'G' (Grid) and press [RETURN] to erase the previous grid. Change the options on the UNITS screen as follows:

Increment:	.25		
Base Window			
Left:	0	Right:	10
Bottom:	0	Top:	
Grids:			
space:	1	divs:	4

When the grids have been drawn, quit out of UNITS.

On the MAIN menu, select 'P' (PROPERTIES) and change the Group Name to 'PLATE' and the text size to .2 x .3. Note the many other properties that each object has. Quit out of PROPERTIES.



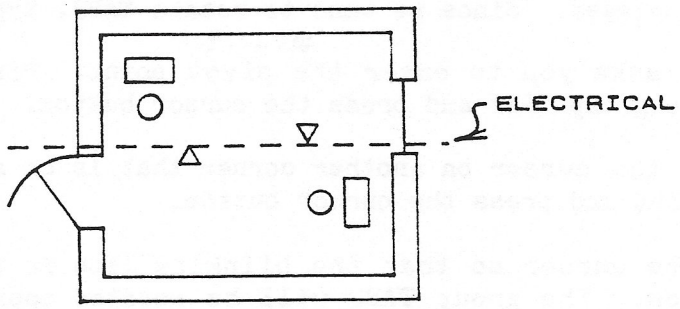
Now go to ADD and using lines and circles, create this drawing with 'increment snap' on. 'Increment snap' is selected with a function key. Refer to your Designer's Reference Manual for instructions on using the 'increment snap'. Add the dimensioning using the Dimension option on the ADD menu. Use lines with the Arrowhead option for the hole dimensions. Use text to enter the diameters.

When the drawing is complete, go to OUTPUT and Specs. Name the plot specs 'A' and choose option 'B'. Use the digitizer to position the plot window to include the entire drawing. Use a scale of 1.0 and X shift = 0 and Y shift = 0. Select 'P' (Plotter) and use plot spec 'A' instead of the default plot spec. Finally, Save your drawing in FILER.

As a review, notice that you now have two copies of your mechanical drawing. One is still in the workfile where all drawings are made. One is in the file where you Saved it.

EXERCISE 4. FLOOR PLAN

This exercise gives us an opportunity to learn about levels, more about groups and how to use 'increment snap' to maintain parallel lines such as the walls in the floor plan.



Clear the screen by choosing New in FILER. Next, go to UNITS and erase the old grids. In UNITS change the options on the UNITS screen as follows:

Increment:	.5	(for 6" wall thickness)	
Base Window			
Left:	0	Right:	40
Bottom:	0	Top:	
Grids:			
space:	2	divs:	2

When the grids have been drawn, quit out of UNITS.

On the MAIN menu, select 'P' (PROPERTIES) and change the group Name to 'FLOOR' and the text size to .4 x .6. Quit out of PROPERTIES.

Now go to ADD and draw just the floor plan without the electrical or furniture.

Next, change the Level to '2' and the group Name to 'TAB1' using the 'U' (Update) option. Note that it is not necessary to go to the PROPERTIES menu to make these changes.

Draw the rectangular table and circular chair in one corner of the room.

We will use the Copy option in Group to copy the table and chair group called 'TAB1' to the opposite corner of the room.

Press 'C' (Copy). The name of the current group (TAB1) will be displayed. Since that is the name of the group that we wish to copy, just press [RETURN].

Next, the program asks you to name the new group. In order to be able to manipulate the copy independently of the original, give the copy a different group name -- 'TAB2'.

Now the program asks you to enter a handle point. While you may select any location on the screen as a handle point, it will be most convenient if you select some point on the group you wish to copy. Position the cursor on one corner of the table and press the cursor button. Now, just move the cursor to the opposite corner of the room where you want the corner of the copy to appear and press the cursor button. A copy of the table and chair will be drawn.

Now, we will rotate the copy (TAB2) as shown in the example using the Rotate option.

At the GROUP menu, select 'R' (Rotate). The name of the current group (TAB1) is displayed. Since we want to rotate TAB2, type 'TAB2' [RETURN].

The program asks you to enter the pivot point. Place the cursor on some corner of the group TAB2 and press the cursor button.

Next, place the cursor on another corner that is on a horizontal line with the pivot point and press the cursor button.

Now, move the cursor so that the blinking line is vertical and press the cursor button. The group TAB2 will be rotated approximately 90 degrees. Note that 'handle points' and 'pivot points' can be anywhere on the screen -- they need not be touching the object to be moved or rotated. However, it is much easier if you select reference points on the objects to be moved rather than just any random point on the screen. Quit out of GROUP.

Go back to ADD. Use Update to change Level to '3' and group Name to 'ELEC' for adding the electrical lighting symbols. Add the electrical to the drawing.

When your drawing is complete, go to SWITCHES. Set All Levels to 'N' then select Levels and type a 'Y' under 1, and an 'N' under 2 and 3 then press [RETURN]. When you Quit out of SWITCHES, note that the furniture and electrical turn off leaving only the floor plan displayed. Now go back to SWITCHES and put a 'Y' under 1, an 'N' under 2 and a 'Y' under 3. Press [RETURN] and Quit out of SWITCHES. Note that the floor plan and electrical now show but not the furniture. Save your drawing in the FILER.

EXERCISE 5. PLOTTING

At the MAIN menu, select Output and plot the floor plan using the default plot spec. Note that only the levels 'turned on' actually plot.

Now, let's replot the drawing to a 1/2" equals 1' scale. To define a specific scale, you need to create a plot spec.

Select 'S' (Spec) on the OUTPUT menu and enter plot spec name (ex. 'FLRPLN').
Select option 'B'.
Position the plot window to include the entire drawing.
Type in a Scale of '.5' (1/2" equals 1').
Type in X and Y offsets of '0'.
At the OUTPUT menu, select 'P' (Plot).
Use plot spec 'FLRPLN'.

SUMMARY

To review what we have learned to this point:

(1) The screen is like a drawing sheet and it displays what is currently in the workfile.
(2) Drawings can be saved from the workfile for later use and can be retrieved from where saved to the workfile. Drawings can only be worked on or plotted from the workfile.
(3) Graphics objects can be added to a drawing and thereafter modified by following the command menu.
(4) Several objects can be collected into a group and then manipulated as a group.
(5) The first step in preparing a drawing is to clear the workfile. The second step is to set up the drawing, that is to set the defaults to be used such as a grid, text size and the coordinates of the screen.
(6) Graphics objects are entered in "real world" coordinates. That is, in feet or meters or miles or inches. For example, if you want to draw a house floor plan, the objects will be entered in their actual dimensions measured in feet. The plot scale or drawing scale is supplied when the drawing is plotted.
(7) Any command can be aborted before completion by pressing the ESCAPE key.
(8) To modify an object, enter MODIFY and cause the object to blink before choosing the command.
(9) Groups of objects can be modified in GROUP using the group name that was assigned in PROPERTIES before the object was added.

Having gone through exercises 1 through 5 it is now important to read the Designer's Reference Manual and then to take on a more complex example from your own discipline.

Application note: Drawing Efficiency Reminders

1. Standardize use of symbol types.

2. Develop standard LEVEL and PEN assignments.

3. Standardize use of GROUP NAMEs between drawings.

4. Use INCREMENT SNAP for most drawing. This allows easier and more accurate placement than no snap function.

5. Use GRID SNAP for initial layout. Redrawing of grid lines can become time consuming when switching between windows or with the SKETCH option.

6. Turn off all LEVELS that are not relevant to the current drawing. This will speed up the redraw time.

7. Avoid excessive use of the window IN and OUT options. Try to establish the BASE WINDOW for greatest drawing area or use the segmented drawing approach with SAVEd window areas.

8. Determine standard TEXT widths and heights for consistency.

9. Use predrawn symbol libraries for quicker and more accurate drawing of standard symbols.

10. Change object and group properties as often as necessary to avoid editing of objects and/or groups after they are input.

11. Always SAVE the workfile to a permanent location when leaving or turning off the computer. Accidents can and will happen.

12. Maintain drawing logs for easy recall of disks and drawings.

13. Input information by LEVELs as much as possible to maintain consistency.

14. Use GUIDES and TEMPLATES to aid in locating objects. Remember though that TEMPLATES are stored on the disk. Delete any TEMPLATES if space becomes a problem.

Application note: Architectural Applications

PURPOSE:

There are many obvious benefits in using the Computer Aided Design (CAD) system for architectural application including:

-ease of making changes and corrections.
-immediate duplication of frequently used symbols and portions of drawings.
-selection of scale for drawing.

These features of any CAD system alleviate many tedious and time-consuming tasks for the designer but the key to maximizing productivity and efficiency is adequate preplanning and a standardized approach. These notes provide suggestions for work standardization to use the features of the CAD system more efficiently with examples of specific application. These notes should be used in conjunction with the CAD Reference Manual which explains each feature of the system and they assume some familiarity with the system.

PROCEDURE:

Many items in an architectural office are already standardized and can be incorporated into the CAD system. These include such things as project control information and the types of symbols used on the drawings. All the standard equipment, material and notational symbols can be put into the computer once and never be redrawn again.

In using the CAD system there are several major areas where standardization can yield substantial improvement in efficiency.

1. Plotter options including linestyle, density, pen, drawing scale.
2. Object and group properties including levels assignments, group names and group properties.
3. Grid, increment and text sizes.

In the system some of the plotter-related options are considered object properties; others are defined as output options. For example, DENSITY is an object property. Although it is only demonstrated when the object is actually plotted.

The LINESTYLEs available depend on the type of plotter being used (refer to the plotter manual or the CAD manual for these values). The use of different LINESTYLEs is generally standardized for the office and a chart of the LINESTYLES and the values that match them should always be handy for reference.

The DENSITY value is the number of times the plotter will overstrike the object being plotted. This is useful to darken an object, but care should be taken if felt-tip or liquid ink is being used so as not to cause bleeding of the pen into the paper. This feature requires some experimentation with the equipment to establish the most suitable use for the application.

The PEN option determines which pen of the plotter will be used to draw that object. Developing PEN tables for assigning various pen weights or colors will help to speed input of this information. PEN tables may be developed as an office standard or as a drawing standard. In either case, this information should be attached to each drawing so the person in charge of plotting will be able to correctly set up the plotter to the operators specifications.

The LEVELs option is very useful in architectural applications by providing the ability to organize information on various clear sheets that may later be overlaid in any manner to achieve the desired drawings. An example would be to layout the floor plan background on one level then on other levels layout items such as notes and dimensions, structural, electrical and mechanical plans. By switching the various levels on or off drawings can be plotted for any configuration of information desired.

A standard LEVEL assignment chart may be developed using the Construction Specification Institute`s 16 division format for categorizing architectural information. This is a very familiar format to specification writers and is the format used by Sweets Catalog. By assigning a LEVEL to each division of the C.S.I. format, an easily understandable standard can be developed that makes entry of various objects very efficient. This, along with the other standards will greatly aid in retrieving information at a later date when changes occur or when information from one drawing is to be transferred to another drawing.

The GROUP to which each object is assigned should be given very careful consideration in order to take advantage of the very powerful Group options. The main purpose of groups is to allow manipulation of related objects. It should be noted that when a group is manipulated all of the objects within that Group Name are included in the manipulation. For example, if the furniture and the notes for a floor plan were given the same GROUP NAME, a mirror image of the furniture layout could cause the notes to be shown in reverse. Proper assigning of GROUP NAMESs will enhance the effectiveness of the CAD system as well as increasing operator speed and accuracy.

In addition to assigning names at the GROUP NAME option, names are also required at the SAVE options in the FILER and WINDOW menus. As numerous drawings and portions of drawings are accumulated, a systematic naming convention for the SAVED files and windows will greatly increase efficiency in retrieving these drawings for correction or for use on other projects. A published naming convention, project and drawing log, and systematic storage of disks allows everyone in the organization to locate any drawing immediately.

TEXT is an area that is fairly easy to standardize. Most offices already have minimum sizes for notes and titles. However developing these standards into a reference chart will be useful for new operators to refer to making the learning period much easier and faster. One point to remember about TEXT is that the actual size of the TEXT on the final drawing will be controlled by the plotting scale. Therefore, a standard text reference chart relating text, standard grid sizes and final plotting scales will greatly enhance productivity. These relationships are easily calculated because the CAD system works in real world units. Refer to the system Reference Manual for additional explanation and examples of determination of text size.

The INCREMENT SNAP function is indispensible for exact placement of objects and should be used as frequently as necessary for accuracy. While there are no set standards for INCREMENT settings, the value should be set to the smallest value of accuracy required for the drawing.

In addition to the INCREMENT setting, the GRID SNAP option allows another method for accurate placement of objects. With GRID SNAP, objects may be located at the intersections of a defined grid layout.

Another area to be considered for preplanning is in drawing layout. Establishing a systematic approach to inputting objects will add to drawing efficiency and accuracy. Having already established guides such as the LEVEL, PEN, DENSITY and GROUP NAME will be a big help. Assigning GROUP NAMES to specific LEVELS and PENS will aid in defining related objects that can be input with the least amount of changing of menus and windows. Learning to recognize related objects and efficiently inputting them comes with experience. These notes only provide a starting point for developing methods that suit your needs and requirements.

The concept of symbol librairies for the CAD system is covered quite well in the Symbol Libraries Via Groups section of the APPLICATION NOTES in the Reference Manual. The only addition or alternate approach would be to save each group of symbols as a separate drawing. Draw each set or portion of a set with coordinates that will locate the symbols outside most of your common drawing area. When the set of symbols is called onto the workfile they will be away from the main drawing. Each symbol can then be moved or copied to its desired location. The remaining symbols can then either be left on the drawing or deleted if more space is required.

The symbols can be added during the drawing process the area for a symbol, such as a door or window, can be marked with TEMPLATE lines. This allows for the symbols to be input accurately after much of the initial drawing is completed. This will save some redraw time during the initial drawing by not having to draw all the symbols during a SKETCH or WINDOW function.

By using the Symbol Library function, complicated objects may be created for repeated use. Standard title block formats can be kept in a Library and recalled for use on a drawing. Special letter styles can also be developed using the CAD system and stored in a Library for special conditions.

An additional idea would be to store commonly used room names or drawing titles as a library to save keying in a lot of text. Common schedule layouts could also be stored in a library for easy retrieval.

The following, see Figure 1, is a simple schematic plan example intended to illustrate some of the concepts presented and to describe some additional functions of the CAD system.

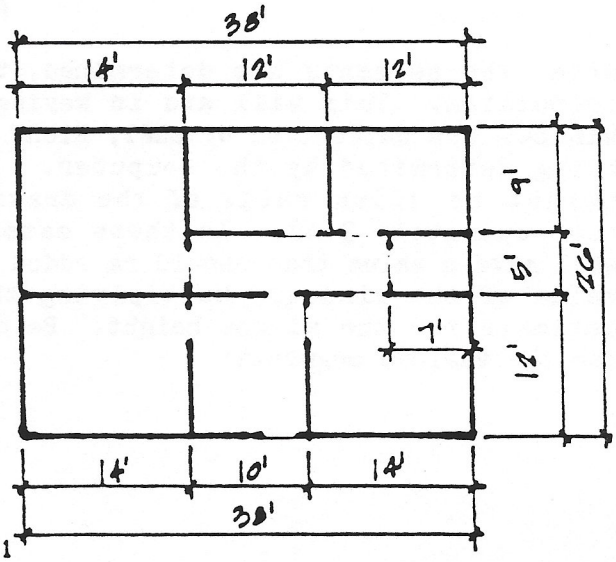


Figure 1

The first step in inputting a drawing is to determine what size the drawing is to be and whether it will be useful to segment the drawing. Segmenting a drawing means to break down a large or complex layout into smaller units in order to more accurately input the information. Having a larger portion of the drawing to work on allows for greater accuracy in placing the objects. By segmenting the drawing, windows can be saved and then used to recall that area of the drawing to work on. This saves much time in WINDOWing IN or OUT of the drawing trying to get just the right area. Even though the example plan is only 38`x 26` we will segment the drawing to illustrate this approach.

In order to begin we will assume that standards have been estblished and from those we have made the following assignments:

GROUP NAME	LINESTYLE	DENSITY	LEVEL	PEN	WIDTH	HEIGHT
FLR	1	2	6	2	n/a	n/a
TEX	n/a	1	17	1	0.7	1.0

The next step should be to determine the coordinates required for the BASE WINDOW and all the various segment windows. The BASE WINDOW sets the base screen coordinates for the drawing. This is usually determined to be the smallest area to define the total drawing area to be worked on. In the example plan the BASE WINDOW is determined to be the 38`x 26`. The next step is to determine the segments for breaking up the drawing. The schematic plan breaks into 6 segments, S1 through S6, that are roughly equal and correspond with some room layouts to help input objects into each room (see Figure 2).

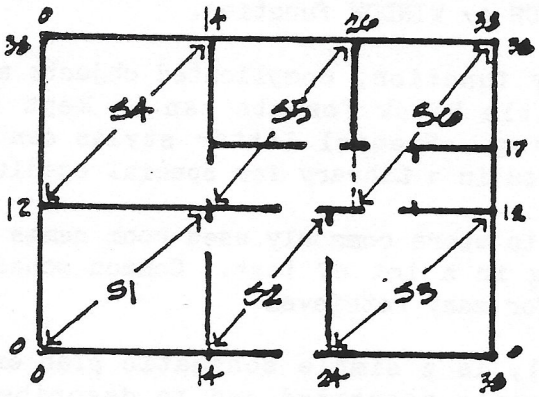


Figure 2

After the segments are determined, the coordinates for each segment should be calculated. This will aid in keying in the windows that will be SAVEd later. Windows are determined by LEFT, RIGHT and BOTTOM coordinate values with the TOP being determined by the computer. It should be noted that in many cases the height to width ratio of the drawing will not be the same as the screen (approximately 3:4). In these cases, multiplying the height required by 1.4 will give a value that should be added to the coordinate determined for the LEFT value of the window. Multiplying the known width by 0.75 will provide an estimate for the window height. Below is a chart of the coordinates estimated for the various segments:

WINDOWS CHART

NAME	LEFT	RIGHT	BOTTOM	TOP (estimated)
BASE WINDOW	0	38	0	(28.5)
S1	0	17	0	(12.75)
S2	14	31	0	(12.75)
S3	24	41	0	(12.75)
S4	0	17	12	(26.75)
S5	14	31	12	(26.75)
S6	26	43	12	(26.75)

At this point, a new workfile may be initialized on the system then the previously determined BASE WINDOW, GRIDS, INCREMENT, OBJECT PROPERTIES and WINDOWS can be input. In this example the values for the FLR group are:

DENSITY = 2, LEVEL = 6, PEN = 2 and GROUP NAME = FLR.
The LINESTYLE and INCREMENT values will remain as 1.

Having determined the initial values, use the ADD function to input the schematic plan using the RECTANGLE and LINE options. Use the X and Y lock function and the Detach function in the LINEs option to locate the lines without having to accurately locate the cursor. Also switching between INCREMENT SNAP and GRID SNAP modes during the middle of inputting an object may be helpful for additional accuracy.

After inputting the lines for the schematic plan exit the ADD menu and change the properties in preparation for entering text. Change the DENSITY to 2, LEVEL = 17, PEN = 1, GROUP NAME = TEX, the TEXT WIDTH = 0.7 and HEIGHT = 1.

Return to the ADD menu and enter the text for segments S1 through S6. Using the GRID SNAP function will aid in placing text on the drawing.

The next step is to set up the segment windows for later recall when detailed work is to be done on a particular segment. Using the ABSOLUTE option input the coordinates for segment S1 (refer to the WINDOWS CHART). For S1 this would be LEFT: 0, RIGHT: 17, BOTTOM: 0 and the TOP value will be calculated as 12.7348. The original drawing is now enlarged showing the section of the drawing labeled S1. SAVE the window with the name S1. Repeat the process with each of the remaining segments, first using the ABSOLUTE option to define the window and then the SAVE option to save that window for later recall.

Once all of the segment windows have been saved they can be recalled at any time from the WINDOW menu with the GET option. This method will save a great deal of time over using the IN and OUT functions for moving to specific parts of a drawing. Use the BASE WINDOW option in the WINDOW menu to return to the full drawing view at any time.

Practice is the biggest aid to developing efficiency. With the experience will come more ideas and methods of standardizing your approach to architectural drawings using the CAD system. The use of the computer for drawing purposes is a new and exciting approach for many architects and just as in learning to use a pencil, once comfortable with it, the advantages will become more apparent than initially realized.

EXAMPLE OF ARCHITECTURAL LEVELS ASSIGNMENT CHART

LEVEL: CATEGORY (Description)

1 : GENERAL DATA (Sheet Borders, Miscellaneous Items)
2 : SITE WORK (Property Lines, Streets, Grading)
3 : CONCRETE (Foundation Plans, Concrete Construction)
4 : MASONRY (Walls, Unit Masonry, Clay Tile, Brick)
5 : METALS (Steel & Metal Framing, Railings, Decking)
6 : WOOD & PLASTIC (Wood Framing, Cabinets, Decking)
7 : THERMAL & MOISTURE PROTECTION (Insulation, Roof`g, Flash`g)
8 : DOORS & WINDOWS (Storefronts, Curtainwalls, Doors, Windows)
9 : FINISHES (Ceiling, Wall & Floor Finishes, Acoustical Mat.)
10 : SPECIALTIES (Signage, Lockers, Fireplaces, Stonework)
11 : EQUIPMENT (Bank, Medical, Laundry, Food Services, Church)
12 : FURNISHINGS (Casework, Furniture, Blinds & Drapes, Artwork)
13 : SPECIAL CONSTRUCTION (Saunas, Pools, Solar/Wind Equipm`t.)
14 : CONVEYING SYSTEMS (Elevators, Dumbwaiters, Pneumatic Tube)
15 : MECHANICAL SYSTEMS (HVAC, Ductwork, Piping, Fire Prot.)
16 : ELECTRICAL SYSTEMS (Outlets/ Lighting/ Communications)
17 : TEXT (Plan Notes, Room Titles)
18 : DIMENSIONS (Drawing Dimensions)
19 : SCHEDULES (Room, Door, Window & Shear Panel Schedules)
20 : REFERENCE SYMBOLS (North Arrow, Section Cuts, Det. Refer.)
21 : PEN 1 (see NOTE below)
22 : PEN 2
23 : PEN 3
24 : PEN 4
25 : PEN 5
26 : PEN 6
27 : PEN 7
28 : PEN 8
29 : PEN 9
30 : spare
31 : spare

NOTE: Levels 21 thru 28 assign a separate pen value to a separate level allowing drawings to be constructed by pen types on different levels. That is, everything to be drawn a LEVEL 23 would be drawn with PEN 3. This would cover drawings that would not have assigned levels by material or use.

Systems that allow for more levels may be broken down in multiples of 10 to allow greater flexibility for input. The levels 1-9 may then include text, dimension and other functions as General Data.

Application note: Mechanical Construction

Objects such as fillets, rounds and other precise geometric objects can best be constructed using "TEMPLATE" objects to construct the figure and then non-template objects to construct the final drawing.

PROCEDURE

1. First, use "UNITS" to set up screen coordinates and to set a working increment, for example: .1 if you wish to work to one-tenth of an inch.

2. Draw an outline of the final part using lines, circles, ellipses and the like. In each case, select "TEMPLATE" and use increment snap.

3. Next draw over the template lines with lines and arcs without choosing the "TEMPLATE" option but still using increment snap.

4. Then go to "SWITCHES" and turn "TEMPLATE" objects off.

EXAMPLE

Suppose you wish to draw a 4" square plate with 1/4" radius rounded corners. First, go to "UNITS" and set the Base window coordinates so the left edge is 0", the right edge is 10" and the bottom is 0". The 2D program will automatically set the top to 7.49" to keep the screen aspect ratio correct. Set increment to .25. While in "UNITS", put up a grid with 1" spacing vertical and horizontal. Next, go to "ADD". Choose Rectangle, and place first corner at 2.0, 2.0. Choose "TEMPLATE" object. Place opposite corner at 6.0, 6.0. Now choose a circle and place center at 5.75, 5.75. Choose "TEMPLATE" option. Use "MODIFY" to copy the circle to the other three corners. Now, back to "ADD". Use lines to trace the straights between tangent points and arcs for the portion of circles. Finally, go to "SWITCHES" and turn off templates.

Application note: Drawing Scale

Objects are entered into the 2D system in "real world coordinates". This means a part is entered in terms of how big it really is rather than how many inches it will be drawn on paper. When a drawing is to be plotted, it is necessary to determine a drawing scale. Drawing scale is the number of inches a length is to be drawn on paper per "real world" unit. For example, if "UNITS" were set for a 10" by 7.49" Base window and the entire window was to be plotted 5" by 3.75" on paper, the scale would be 0.5. That is, half scale or 1/2" on paper per "real world" inch.

This section describes how to select an appropriate scale for several situations.

GENERAL PROCEDURE

1. The best way to determine the appropriate scale is to "work backwards". Given the size of plotter paper in inches and the "real world" size of a part to be drawn, the scale is calculated by dividing the paper size by the "real world" size of the part.

2. Enter the desired scale through plotter specs.

SPECIFIC EXAMPLES

1. Suppose a floor plan is 30' high by 40' wide on the screen and it is desired to put the drawing on a 10" high by 14" wide sheet. A scale of 1/4" per foot will be fine since 1/4 x 30 is less than 10" and 1/4 x 40 is less than 14". Note that this is like an architect's scale: 1/8" per foot, 1/4" per foot, etc. Enter the number in "SPECS" as a decimal fraction.

2. If the part is in inches of the screen, the scale to be entered is like typical mechanical drafting, that is, inches on paper per inch of part. For example, quarter-scale would show the object drawn 1/4" on paper for every 1" of part length. Enter the number as .25 in plot specs.

3. If the part is in the metric system the same rules apply even though it may seem somewhat unorthodox. The plot scale might be expressed as inches on paper per millimeter of "real world" coordinates.

4. If the part is in meters and "inches per meter" is OK for scaling, enter the scale directly. One inch per meter would be entered as a scale of 1.

Application note: Text Size

Text size is entered through "PROPERTIES" in screen units anticipating some plotting scale. If the drawing is plotted to a different scale it is necessary to change all the text in screen units so the letters will be the desired size when plotted.

PROCEDURE

1. To start, set text size in "PROPERTIES". If plotting to scale .25 and you want quarter inch high letters, enter text as 1.0 high. Keep height to width ratio around 1.5 to 1. So width =, say, .7.

2. If you decide to change the plotted scale but you want characters to remain quarter inch you must go through "MODIFY" to change the scale. Use "SCALE" on the "MODIFY" menu rather than "SCALE" on the "TEXT" menu. Use "FACTOR" so the characters will all be made the same new size.

TEXT SIZE

ARCHITECTURAL SCALE	TEXT HEIGHT			
	1/8"	3/16"	1/4"	1/2"
1/8	1'	1'-6"	2'	4'
1/4	6"	9"	1'	2'
3/8	4"	6"	8"	1'-4"

STEPS:

1) CHOOSE SCALE.

2) CHOOSE TEXT SIZE.

3) ENTER TEXT SIZE IN 'PROPERTIES'.

Application note: Group Libraries

A group library is a collection of frequently-used drawings or symbols that may be quickly retrieved for use in any drawing. A group symbol may consist of a few circles and lines representing an electronic component or it may be an entire standard detail. Using the 2D drafting system, you can easily create group libraries which are plotted on a 10 X 10 grid and placed on the digitizer tablet. Groups can then be 'picked' from this grid and moved onto the drawing merely by touching the desired picture on the digitizer.

PROCEDURE

The following is one suggested procedure for creating a group library. We will use architectural symbols in this example and we will concentrate on creating the library rather than creating a regular drawing. You can also create a library or add group symbols to an existing library at any time without clearing the workfile.

Before you begin to create a group library, you should have at least one blank formatted diskette on hand to store your library. It would be a good practice to name this disk appropriately (for example, LIB1: to contain library files) and to store only libraries on 'library disks' -- one library per disk.

The steps in creating a new library are as follows:

(1) Create a drawing with each symbol as a separate named group. For example, you could create a drawing with three groups: TUB, SINK, and REFRIG. Each object should be drawn in its 'real world' size. This drawing may be either in the workfile or saved on a disk.

(2) Make a new library as follows: Select the LIBRARY option off the MAIN MENU and then select the MAKE option off the LIBRARY menu. Give the library a name. For example, you might name an architectural library ARCHLIB. The library file will be created on the disk in the drive assigned for libraries in ENVIRO. The program will prompt you to insert the library disk (LIB1:) into the appropriate drive.

(3) At the LIBRARY menu, select the GROUP option and then select the ADD option to add each group, TUB, SINK, and REFRIG, to the library. Assign each group to one of the 100 positions in the library. The program will prompt you to insert the library disk in the appropriate drive.

(4) When you have finished adding groups to the library, use the NEW option off the FILER menu to clear the workfile of all information. Return to the LIBRARY menu and select the OVERLAY option to create the the group library overlay. The overlay is the 10 X 10 grid showing each group in its assigned library position.

(5) When the overlay is completely drawn on the screen, select the OUTPUT option off the MAIN MENU and plot the overlay using the predefined plot spec called 'OVERLAY'. Tape the plotted overlay to the digitizer surface.

To use the group symbols from the new library:

(1) Before you can select a group from the library, you must identify (name) the active library using the NEW option off the LIBRARY menu. Use the digitizer to indicate the lower left and upper right corners of the library overlay.

(2) When you want to place one of the group from the library on the drawing, select the GROUP option off the ADD menu. The program will prompt you to place the library disk (LIB1:) in the appropriate drive. Touch the desired symbol on the digitizer tablet with the digitizer, then position the symbol on the drawing as usual using the cursor.

Application note: Two Screen System

Apple-compatible computers can support a two screen system -- menus are continuously displayed on one screen and the drawing is displayed on another screen.

PROCEDURE

(1) Purchase a Videx Videoterm card and install it in slot #3 of the computer. Do not install the soft-switch device. These cards cost around $300.

(2) Purchase a second screen. The Zenith green screen or the APPLE III screen may be used for both the graphics and the menus or you may prefer to use a small (7 inch) screen such as a Sony or a PSI screen for the menu screen.

(3) Connect the short cable provided with the Videx card with the small 3 prong connector on the forward edge of the card and arrange other end of the cable to protrude through one of the slots in the rear of the computer. Connect the regular video cable from the menu screen with the short cable from the Videx card.

(4) Connect the video cable from the graphics screen with the normal video output on the back of the computer.

Now, you have a two screen system. The software will automatically send text (in 80 column form) through the Videx card to the menu screen and the software will send the drawing or the drawing plus text (5/6 screen) to the screen connected to the video output.

Execute the ENVIRO program and change 'Two screens' to Y (Yes). Refer to the ENVIRO Manual for detailed instructions.

NOTES: You must have a second screen attached to the Videx card if you have the card in the computer.

You should not use the Videx card simultaneously with an APPLE IIe 80 column card.

Application note: Speedup

INSTALLATION PROCEDURES FOR VARIOUS SPEED-UP HARDWARE

1. INSTALLATION PROGRAMS FOR SPEED-UP CARDS

If you are using certain speed-up cards with your system, you must run special installation programs to make changes to the 'BOOT' disk to utilize these cards. The cards that require these special installation programs are The MILL, VITAMILL, ACCELERATOR II. These installation programs are generally used only one time and the changes to the 'BOOT' diskette are permanent.

1.1 THE MILL / THE VITAMILL

Before you begin this procedure, you must have THE MILL or THE VITAMILL card installed in the computer. Note which slot it occupies. You must also be working with an unaltered COPY of your 'BOOT' disk. DO NOT MAKE CHANGES TO THE MASTER DISKETTE.

Place the 'ASAP' diskette that you received with THE MILL or VITAMILL card in volume #4 and boot up the computer.

In a few seconds, the ASAP Advanced Software notice is displayed.

You type:	The computer responds:
[return] (to proceed)	Which slot ... (0..7) ?
7	Do you desire an interpreter ...
N	Are any disk units shared ...?
N (answer 'Y' if your system is networked)	Are any disk units fixed ...?
N (answer 'Y' if you are using a hard disk)	Insert your Application disk ...
Insert the copy of your 'BOOT' diskette in vol #4. Press [return]	Insert the ASAP disk
Insert the ASAP disk in vol #4 and press [return]	Insert a WRITABLE COPY ...
N [return]	If you are sure that you want ...
Insert the copy of your 'BOOT' diskette in vol #4. Press [return]	Your Application diskette has modified to take advantage ... ... modify another disk?
N	Your application diskette ...
Label the 'BOOT' disk to indicate that THE MILL/ VITAMILL has been installed. Reboot with this diskette and use for everyday use.	

1.2 ACCELERATOR II

The following installation procedure is necessary only if you have installed the ACCELERATOR II in slots 1 through 7. Before you begin this procedure, you must have the ACCELERATOR card installed in the computer. Note which slot it occupies. You must also be working with a COPY of your 'BOOT' disk. DO NOT MAKE CHANGES TO THE MASTER DISKETTE.

Place the ACCELERATOR II Pre-boot disk in disk volume #4 and boot up the system. A menu is displayed -- 'YOUR ACCELERATOR ...' Ignore this menu and continue with instructions.

You type:	The computer responds:
[ctrl] C	BREAK IN 620
BRUN MODIFY [return]	1. MODIFY PASCAL BOOT ....
1 [return]	Insert your ...
Insert your COPY of the 'BOOT' disk in volume #4 and press [return].	Modification successful.

After you finish the installation of all the hardware, be sure that you execute the ENVIRO program and change the Booster option to recognize the 'ACCELERATOR II' card.

1.3 AXLON RAMDISK

The following installation procedure is necessary only if you are using an AXLON RAMDISK 320. Before you begin this procedure, you must have the AXLON RAMDISK card installed in slot #4 of the computer and the floppy disk drive controller installed in slot #6 of the computer. You must also be working with a COPY of your 'BOOT' disk. DO NOT MAKE CHANGES TO THE MASTER DISKETTE.

Transfer the following files from the 'AXLON PASCAL' diskette (provided with your ramdisk system) to a COPY of your master 'BOOT' diskette. Use the Filer TRANSFER option to do this.

```
SYSTEM.ATTACH
ATTACHUD.CODE
ATTACH.DATA
ATTACH.DRIVERS
```

The next step requires that you zero the ramdisk's directories. First, turn on the power to the ramdisk. Boot up the computer using the copy of the master 'BOOT' disk that you have just made.

The Pascal COMMAND menu will shortly appear on the screen. Use the Filer ZERO option to clear the directories of volume #9: and volume #10:. Name volume #9: 'AX1:' and name volume #10: 'AX2:'.

Next, you must transfer the following 2D files from their respective 2D drafting disks to the designated AXLON RAMDISK volumes. The following table lists the 2D files that should be transferred to volume #9: and volume #10: of the ramdisk.

VOLUME #9: (AX1:)	VOLUME #10: (AX2:)
CODE: 2D30.CODE	WORK: MENU30.DATA
BOOT: ENVIR030.CODE	WORK: MESS30.DATA
BOOT: CONV2.7.CODE	WORK: HATCH30.DATA
	WORK: LIB30.DATA
	CODE: PSTROKES30.DATA
	CODE: SSTROKES30.DATA
	BOOT: FORMAT.CODE
	BOOT: FORMATTER.DATA

Once these files have been transferred to the AXLON RAMDISK, you must setup the correct file volumes by running the ENVIR030 program. Setup the environment fields so that they look like the following configuration:

```
Workfile size in objects          1200

Input:        Digitizer
Output configuration:
   interface:    CCS 7710-01      slot #2
   plotter:      DMP-40
   right limit:  15.0000
   top limit:    9.25

Booster:         No
two Monitors:    No
two Drives:      No

File volumes:
   2D30.CODE:          #9
   2D30.WRK.DATA:      #10
   MENU30.DATA:        #10
   MESS30.DATA:        #10
   HELP30.DATA:        #5
   PSTROKES30.DATA:    #10
   SSTROKES30.DATA:    #10
   HATCH30.DATA:       #10
   LIB30.DATA:         #10
   DRAWING FILES:      #5
   LIBRARY FILES:      #5
```

Once the environment is correctly configured, you can run the 2D program. Simply boot up the computer using the new 'BOOT' disk and execute the file '#9:2D30'.

SETTING UP A CORVUS HARD DISK SYSTEM

1. PURPOSE

The purpose of this document is to assist drafting system users through initialization and loading procedures for a CORVUS hard disk system. This outline configures the system on an uninitialized disk for Pascal only and includes instructions for both single user and multi user systems.

2. INTRODUCTION

This outline covers the following steps:

- -- Initializing the hard disk for Pascal.
- -- Copying the programs and files for the 2D drafting system onto the hard disk.
- -- Setting up the work environment for a single-user system.
- -- Adding Omninet Constellation software
- -- Suggested configurations and work environments for multi-user system.

This outline is intended to help you through the initialization and loading of the hard disk and does not replace the CORVUS documentation. You must read the CORVUS installation documentation regarding unpacking, indicator lights, switch settings, and computer and drive connections. We suggest that you read the CORVUS initialization instructions using this outline as an example of a practical configuration.

To make the following procedure more clear, we use specific names and sizes for volumes on the hard disk. These are completely arbitrary -- you may change them to suit your needs.

Before you begin, you should have the following on hand:

a) APPLE computer with two floppy disk drives. (If you have only one floppy drive, you will need to adjust these instructions for transferring files.)

b) The CORVUS hardware including disk and interface card.

c) The CORVUS Disk and Network System Manual

d) The diskettes supplied with your CORVUS hard disk.

e) At least one blank formatted diskette.

f) The four diskettes supplied with the 2D drafting system.

You should have read the Introduction to CORVUS Systems and completed the hardware installation according to the CORVUS manual. IF YOU ALREADY HAVE DATA ON THE HARD DISK, YOU SHOULD BACK IT UP ON FLOPPIES.

3. INITIALIZING THE HARD DISK

The major steps in this initialization procedure are:

Create a BRINGUP diskette with APPLE and CORVUS files.
Execute the PSYSGEN program to initialize the CORVUS volume table and boot tracks and to copy the Pascal operating system onto the first volume of the hard disk.
Rearrange interface cards to boot from the hard disk.

3.1 CREATE A BRINGUP DISK

TURN OFF POWER to the computer and to CORVUS devices.
Insert the CORVUS interface card in slot #2 of the computer. (This is a temporary arrangement.)
Insert the diskette controller card in slot #6 of the computer.
Insert the drafting system 'BOOT' diskette in vol #4 and a blank formatted diskette in vol #5.
Boot the computer. Do not turn on the hard disk.

Create the BRINGUP diskette to contain APPLE system files and CORVUS files using the following procedure:

At the Pascal COMMAND menu:

You type:	The computer responds:
F (Filer)	Filer: G, S, N, ...
C (Change)	Change?
#5: [return]	Change to what?
BRINGUP: [return]	BLANK: --> BRINGUP:
T (Transfer)	Transfer?
#4:?,#5:$ [return]	The computer displays each file answer Y to the following files: SYSTEM.PASCAL, SYSTEM.APPLE, SYSTEM.MISCINFO, SYSTEM.FILER, and SYSTEM.LIBRARY. Answer N to all other files.

Insert the CORVUS AP Pascal Utilities vol 1 diskette in vol #4.	
T (Transfer)	Transfer?
#4:?,#5:$ [return]	Each file will be displayed. Answer Y to the following files: BOOT.DATA, DIAG.DATA, and PSYSGEN.CODE.
L (List)	Dir listing of ?
#5: [return]	The files on the BRINGUP: disk are listed as follows: (the order is not important) SYSTEM.PASCAL, SYSTEM.APPLE, SYSTEM.MISCINFO, SYSTEM.FILER, SYSTEM.LIBRARY, BOOT.DATA, DIAG.DATA, PSYSGEN.CODE

3.2 EXECUTE THE PSYSGEN PROGRAM

Reboot the computer with the new BRINGUP diskette in vol #4. Turn on the CORVUS disk drive. When the READY light is the only light on, you are ready to continue.

At the Pascal COMMAND menu:

You type:	The computer responds:
X (eXecute)	Execute what file?
PSYSGEN [return]	PSYSGEN Utility version ... OK to destroy all data ...?
Y	Opening file BOOT.DATA ... PSYSGEN Operation Finished COMMAND: E(dit ...

The hard disk is initialized for Pascal and it contains the files necessary to boot. Remove the BRINGUP: diskette from the floppy drive and put it away in a safe place in case it is necessary to reinitialize the hard disk.

3.3 REARRANGE THE CONTROLLER CARDS TO BOOT FROM THE HARD DISK

TURN OFF THE POWER TO THE HARD DISK THEN TO THE COMPUTER.

Open the computer and move the floppy disk controller card to slot #4. Move the CORVUS interface card to slot #6. If you intend to have a plotter interface card in slot #2, you can put it in now. Check that all cables are firmly connected to the appropriate cards and that the cables are arranged to protrude neatly through the back openings of the computer. Replace the lid, power on the computer and then the hard disk. You should have no diskette in the floppy drive. Wait until the READY light on the front panel of the hard disk is the only light on before continuing.

Verify that the hard disk volume is on line then rename the new volume as follows:

At the Pascal COMMAND menu:

You type:	The computer responds:
F (Filer)	Filer: G, S, N, ...
V (Volumes)	Vols on line 1 CONSOLE: 2 SYSTERM: 4 # BRINGUP: Root vol is BRINGUP: Prefix is BRINGUP: It is important to note that the hard disk is now vol #4.
C (Change)	Change?
#4:,SYS: [return] (Change the name of vol #4 on the hard disk to SYS: as is will contain the system and CORVUS files)	BRINGUP: --> SYS:
V (Volumes)	Note that #4 is now SYS: and the Prefix vol is SYS:

4. COPY CORVUS FILES ONTO THE HARD DISK

Insert the CORVUS AP
vol 1 Pascal diskette
into the #1 floppy drive.
Note that the #1 floppy
drive is now called vol #9
because the floppy controller
is in slot #4.

T (Transfer)	Transfer?
#9:=,#4:$ [return]	Each file on the diskette is transferred to the hard disk. When the program comes to a file that has already been transferred it asks Remove old ... ? Answer N each time.
Insert the CORVUS AP vol 2 Pascal diskette into vol #9 and repeat this Transfer procedure.	Filer: G, S, ...

If you are initializing a 5 or 10 MB drive, the initialization process is complete. You should press Q to return to the Pascal COMMAND menu then proceed with the next section to add volumes for the drafting software.

If you are initializing a 20 MB drive you need to initialize the second half of the drive as follows:

At the Pascal COMMAND menu:

You type:	The computer responds:
X (eXecute)	Execute what file ?
VINIT [return]	VINIT: I(nit ...
I (Init)	Initialize volume ...
2 [return]	VINIT: I(nit ...
Q (Quit)	COMMAND: E(dit ..

The initialization process is complete and all the system and CORVUS files for a single-user system have been transferred to the hard disk.

5. ADD A VOLUME FOR DRAFTING SYSTEM SOFTWARE

The following sections consist of a procedure for adding a volume for the 2D drafting system software. This procedure is intended only as a brief guide and does not replace the documentation supplied with the hard disk. We recommend that you read the section Drive Management for Single User System (Pascal) in the CORVUS documentation.

The initialized hard disk now has one volume SYS: containing all the system files and CORVUS utilities. We will add additional volumes for the drafting system programs and files. Some information might be helpful at this time. The operating system recognizes only 6 volumes at any one time. It identifies them as volumes 4, 5, 9, 10, 11, and 12. Each volume can contain up to 77 files.

On the APPLE computer, the computer boots from the device connected with the controller in slot #6 in the computer. The operating system identifies the boot volume as volume #4 and it MUST contain the Pascal system files in order to boot. The floppy disk controller card is now in slot #4 in the computer. The two floppy disks connected with that controller are identified as volumes #9 and #10. Therefore, you have volumes #5, #11, and #12 that you can assign to the hard disk. Are you still with us??? You can use these volumes as you wish. We suggest that you create one new volume, CAD30, on the hard disk to contain the 2D drafting system software.

5.1 CREATE A NEW VOLUME FOR THE DRAFTING SOFTWARE

At the Pascal COMMAND menu:

You type:	The computer responds:
X (eXecute)	Execute what file?
VMGR [return]	VMGR: Q L(ist, ...
L (List)	(SYS: is displayed with 1024 blocks)
N (New)	New Volume: ... Name:
CAD30 [return] (drafting program files version 3.0)	Enter length ... 1024
[return]	Enter Corvus drive #:1
[return]	Enter Address ...
[return]	VMGR: Q L(ist, ...
M (Mount)	Mount: Enter volume name
CAD30 [return]	Mount CAD30 ...?
5 [return]	CAD30: mounted.
L (List)	SYS: and CAD30: are displayed.
Q (Quit)	Change default Mount Table ?
Y	COMMAND: E(dit, ...

5.2 TRANSFER DRAFTING PROGRAMS AND FILES TO THE HARD DISK

Insert the 'BOOT' diskette from the drafting system into the floppy drive. At the Pascal COMMAND menu:

F (Filer)	Filer: G, S, N, ...
T (Transfer)	Transfer ?
#9:=,#4:$ [return]	All the files are transferred from the 'BOOT' diskette to volume SYS: on the hard disk. When it finds files that were already transferred, it asks Remove old ...? Type N.

Insert the 'CODE' diskette from the drafting system into the floppy drive.

T (Transfer)	Transfer ?
#9:=,#5:$ [return]	All the files are transferred from the 'CODE' diskette to volume CAD30 on the hard disk.

Repeat the transfer procedure above with the 'WORK' and 'HELP' diskettes. When all the files are copied, put the four master diskettes away in a safe place in case you ever need to recopy them onto the hard disk.

R (Remove) (remove a duplicate file)	Remove?
#5:SYSTEM.LIBRARY [return]	Update directory ?
Y	Filer G, S...
L (List)	Dir listing of?
#5: [return]	The following files should be listed on vol CAD30: PSTROKES30,DATA, SSTROKES30.DATA 2D30.CODE, LIB30.DATA, HATCH30.DATA, MENU30.DATA MESS30.DATA, 2D30.WRK.DATA, HELP30.DATA
Q (Quit)	COMMAND: E(dit ....

The hard disk now contains all the programs and files necessary to run the drafting system. If yours is a single user system, proceed with the next section 'Single User Work Environment'. If you are configuring a multiuser Omninet system, turn to the section 'Configuring a Network System'.

6. SINGLE USER WORK ENVIRONMENT

This section contains a procedure to create volumes for the workfile and drawing files. It also includes a suggested configuration for the work environment.

6.1 ADD VOLUMES FOR SINGLE USER

A single user generally has both the workfile and the drawing files on the hard disk. Add new volumes as follows:

At the Pascal COMMAND menu:

You type:	The computer responds:
X (eXecute)	Execute what file?
VMGR [return]	VMGR: Q L(ist, ...
L (List)	(SYS: and CAD30: are shown; note the starting addresses and length in blocks.)
N (New)	New Volume: ... Name:
WORK30 [return] (Work file volume -- version 3.0)	Enter length ...
600 [return]	Enter Corvus Drive #
[return]	Enter Address ...
[return]	VMGR: Q L(ist, ...
L (List)	Corvus Volume Directory ... (SYS:, CAD30:, WORK30 displayed)
M (Mount)	Mount: Enter volume name
WORK30 [return]	Mount WORK30 ...?
11 [return]	WORK30: mounted.

Add another new volume, DRAW30, to hold saved drawings. Depending on how you want to use the remaining space on the hard disk, you can either use all of the remaining space or save some for some other use. Mount DRAW30 on volume #12.

Q (Quit)	Change default Mount Table ?
Y	COMMAND: E(dit, ...

6.2 CHANGING THE 2D DRAFTING ENVIRONMENT FOR SINGLE USER

Use the ENVIRO program as described below to make a larger workfile and to tell the system where all the files reside. Please refer to the ENVIRO manual for more detailed instructions.

At the Pascal COMMAND menu:

You type:	The computer responds:
X (eXecute)	Execute what file?
ENVIRO30 [return]	ENVIRONMENT MENU ....

Change the workfile size to the desired number of objects -- average 1000 to 2000; maximum 4000. The maximum size that will fit on a floppy disk is 2000.

Change the Input, Output, Booster, Monitors as necessary to match your system. Change Two Drives to NO.

Now change the file volumes as follows:

A (Alternate menu) ENVIRONMENT MENU2 ...

F (File volumes)

Set file volumes as follows:

2D30.CODE:	#5
2D30.WRK.DATA	#11
MENU30.DATA	#5
MESS30.DATA	#5
HELP30.DATA	#5
PSTROKES30.DATA	#5
SSTROKES30.DATA	#5
HATCH30.DATA	#5
LIB30.DATA	#5
DRAWING FILES	#12
LIBRARY FILES	#9

Q (Quit) COMMAND: E(dit ...

Your system is now completely configured to run from the hard disk with the workfile and the drawings stored on the hard disk and the libraries on the floppy disk.

To execute the drafting program:

X (eXecute)	Execute what file?
CAD30:2D30 [return]	Two-Dimensional Drafting ... Press [RETURN] to continue

7. CONFIGURING A NETWORK SYSTEM

The following sections of this document consist of instructions for loading Constellation software and an example configuration for a multi-user system. For this example, we will configure the system for a typical educational installation with several workstations. The drafting programs and files will be on the hard disk and each user's workfile and drawings will be on his own floppy diskettes. The group libraries may be on either the hard disk or on floppies.

Before you begin, you should have the Omninet transporter card in slot #6 of the computer and a floppy disk controller in slot #4. You must have completed the the initialization of the hard disk for Pascal. The following procedure assumes that you have completed the previous sections of this outline and that you have loaded the 2D drafting software onto the hard disk.

This procedure has the following major steps:

-- Creating a private volume for the System Manager.
-- Initializing the drives for the Constellation software.
-- Setting up the Logon screen.
-- Configuring the System Manager's access tables
-- Creating a new user and configuring the access tables.
-- Setting up the work environment.

7.1 CREATING A PRIVATE VOLUME FOR THE SYSTEM MANAGER

Regardless of the necessity for security in your organization, you will probably want to reserve certain tasks and certain areas of the disk for the System Manager. Use the following procedure to create a private volume for the System Manager, to give him a password, and to transfer files to his private volume.

Turn on the power to the CORVUS devices and to the computer as described in the CORVUS documentation.

At the Pascal COMMAND menu:

You type:	The computer responds:
F (Filer)	Filer: G, S, ...
V (Volumes)	Volumes on line ... (check that SYS: is the Prefix volume)
Q (Quit)	COMMAND: E(dit ...
X (eXecute)	Execute what file?
VMGR [return]	VMGR: Q ....
N (New)	Enter Volume Name:
PRIVATE [return] (make a private volume for the SMGR)	Enter Length (Blocks):1024
512 [return]	Enter CORVUS Drive # ...:1
[return]	Enter Address ...
[return]	VMGR: Q ...
M (Mount)	Mount: ...Volume Name:
PRIVATE [return]	Mount PRIVATE on ...
12 [return]	PRIVATE: Mounted
Q (Quit)	Change default mount table ?
Y	COMMAND: E(dit ...

Now transfer the System Manager's files from SYS: to PRIVATE: as follows:

You type:	The computer responds:
F (Filer)	Filer: G, S, ...
T (Transfer)	Transfer ?
#4:?,#12:$ [return]	Type Y for the following files: VINIT.CODE, SETBOOT.CODE DIAGNOSTIC.CODE CFxx.x.DATA, PSYSGEN.CODE DIAG.DATA, BACKUP.CODE RESTORE.CODE Type N for all other files.
R (Remove)	Remove what file?
SYS:? [return]	Type Y for each file listed above. Update the directory?
Y	Filer: G, ...
K (Crunch)	Crunch ?
SYS: [return]	From End of Disk ....
Y	SYS: crunched.
Insert the Constellation Utilities diskette in the floppy drive.	
T (Transfer)	Transfer ?
#9:?,SYS:$ [return]	Type Y for each file listed below: CORVUS.LIBRARY, SHARE.TEXT, SHARE.CODE, SPOOL.TEXT, SPOOL.CODE, USERDEMO.TEXT, USERDEMO.CODE
T (Transfer)	Transfer ?
#9:?,PRIVATE:$ [return]	Type Y for each file listed below: CMGR:CODE, SETBOOT.CODE (remove old SETBOOT.CODE)
Q (Quit)	COMMAND: E(dit, ...

7.2 INITIALIZE DRIVE FOR CONSTELLATION

Use the VINIT program to initialize drives for Constellation software. If you are upgrading from a single user system, you need to transfer CORVUS Omninet utilities and new Pascal Constellation utilities to the hard disk.

X (eXecute)	Execute what file ?
PRIVATE:VINIT [return]	VINIT: I(nit, D(osvol,...
C (Constellation)	If you have a 20 MB drive, the system asks Which drive ... 1
1 [return]	This program will ... continue ?
Y	The Constellation user table ... confirm zero user table:
Y	VINIT: I(nit ...
Q (Quit)	COMMAND: E(dit ...

If you have a 5 or 10 MB disk, proceed to the next section, 'Set Up The Logon Screen'. If you have a 20 MB disk, you need to create the first volume for the second logical drive. Execute VMGR and create a new volume (SYS2:) of length 136 blocks on drive 2 with starting address of 8. Mount SYS2: on unit #10. Quit and change the default mount table.

Use the system Filer to change the Prefix to SYS2:.

X (eXecute)	Execute what file ?
PRIVATE:VINIT [return]	VINIT: I(nit, D(osvol,...
C (Constellation)	If you have a 20 MB drive, the system asks Which drive ... 1
2 [return]	This program will ... continue ?
Y	The Constellation user table ... confirm zero user table:
N	VINIT: I(nit ...
Q (Quit)	COMMAND: E(dit ...

7.3 SETTING UP THE LOGON SCREEN

If you plan to have both Pascal and Basics on the system, please refer to the CORVUS manual section 'Adding BASICS to Pascal'. Otherwise, proceed with the following section to set up the logon screen.

X (eXecute)	Execute what file?
PRIVATE:SETBOOT [return]	Basics Pascal Const esc
C (Constellation)	Opening BOOT.DATA
Q (Quit)	Corvus Boot now set to Constellation COMMAND: E(dit...

7.4 CONFIGURING SYSTEM MANAGER'S ACCESS TABLES

The Constellation software is now installed. Re-boot the computer. The CORVUS Constellation screen will be displayed. Log-on as the System Manager and configure his access tables.

At the Constellation logon menu:

You type:	The computer responds:
SMGR [return]	COMMAND: E(dit, ...
X (eXecute)	Execute what file ?
VMGR [return]	System Manager: ...
U (User)	User Manager: ...
R (Remove) (You must remove a user to change the logon or password)	Enter User ID:
SMGR [return]	Removing user SMGR
A (Add) (Re-add the System Manager)	Enter User ID:
SMGR [return] (or any 4 letter name)	Enter password ...
xx [return] (2 letter password)	Enter BASIC ... 0
[return] (zero)	default: Pascal or Basic
[return] (Pascal)	User Manager: ...
Q (Quit)	System Manager: ...

S (Supervise)	Enter User ID:
SMGR [return]	Supervisor: Q ...
I (Init)	Supervisor: Q ...
L (List)	All existing volumes are displayed for the System Manager. If you are setting up this disk from the beginning of this procedure, you will have the following volumes: SYS: Volume #4 CAD30: Volume #5 PRIVATE: Volume #12 If you are adding the Constellation system to an existing single user system you may have other volumes.
Q	System Manager: ...

8. CREATING A NEW USER

For this system, we will add a new user logon 'CAD30' onto the system. All persons using the 2D drafting system will logon to the computer as CAD30. They will share access to the drafting system programs and files on the hard disk but each user will have his workfile and drawing files on the floppy disk.

To add new users you must be logged on as the System Manager (SMGR). At the System Manager menu:

You type:	The computer responds:
U (User)	User Manager: ...
A (Add)	User ID:
CAD30 [return]	Enter password:
xx [return] (passwork -- 2 character)	Enter BASICs home volume
[return] (zero)	default: Pascal or Basics
[return] (Pascal)	User Manager: ...
L (List)	Users are listed -- SMGR and CAD3
Q (Quit)	System Manager: ...

S (Supervise)	Enter User ID:
CAD30 [return]	Supervisor: Q L(ist ...
A (Add)	New Volume: ...
SYS: [return] (all users need access to the system files)	Supervisor: Q ...
M (Mount)	Mount: Enter volume name
SYS: [return]	Unit #:
4 [return]	Warning ... continue ?
Y	Supervisor: Q ...
W (Write-protect)	Protect: Enter Volume Name:
SYS: [return]	SYS: now WRITE PROTECTED

Add and mount volume CAD30: on unit #5 as above.
Write-protect volume #5.

Q (Quit)	System Manager: ...

If you want to have Group Libraries stored on the hard disk, create a new library volume using the following procedure. Otherwise, press Q (Quit) to return to the Pascal COMMAND menu then proceed to the next section 'Set Up The Work Environment.

At the System Manager menu:

You type:	The computer responds:
N (New)	New Volume ...
LIB30 [return]	Enter length ..
1024 [return]	Enter Corvus Drive #
[return]	Enter Address
[return]	System Manager: ...
S (Supervise)	Enter User ID ...
CAD30 [return]	Supervisor: Q ...
A (Add)	Unit #:
LIB30: [return]	Supervisor: Q ...
M (Mount)	Mount: Enter Volume Name:
LIB30: [return]	Mount LIB30: on ...
11 [return]	Supervisor: Q....
W (Write-protect)	Protect: Enter volume name:
LIB30: [return]	LIB30: now WRITE-PROTECTED
L (List)	Note the volumes that are mounted for this user.
Q (Quit)	System Manager: ...
S (Supervise)	Enter User ID:
SMGR [return]	Supervisor: Q ...
A (Add)	New volume: ...
LIB30: [return]	Supervisor: Q ...
L (List)	All the System Manager's files are displayed.
Q (Quit)	System Manager: ...
Q (Quit)	COMMAND: E(dit,

9. SETTING UP THE WORK ENVIRONMENT FOR A MULTI-USER SYSTEM

Use the ENVIRO program to tell the system where the files are to be found.

At the Pascal COMMAND menu

You type:	The computer responds:
X (eXecute)	Execute what file ?
ENVIRO30 [return]	Environment Menu1: ...

Make necessary changes in the workfile size, input device, and plotter. The maximum number of objects that can fit on a floppy disk is 2000. If each workstation has one floppy disk, you must decide how you want to utilize that space. You could have a small workfile (450 objects) which would allow room to save 3 drawings on the same disk. You could have a 2000 object workfile and not save the drawing at all (remember -- you cannot remove the disk containing the workfile while using the 2D system). If each workstation has two floppy disks, you can have the workfile diskette on one floppy drive and save drawings to the other floppy drive.

A (Alternate menu)	Environment Menu2 ...
F (File Volumes)	

	One floppy drive	Two floppy drives
2D30.CODE	#5	#5
2D30.WRK.DATA	#9 (floppy)	#9 (floppy)
MENU30.DATA	#5	#5
MESS30.DATA	#5	#5
HELP30.DATA	#5	#5
PSTROKES30.DATA	#5	#5
SSTROKES30.DATA	#5	#5
HATCH30.DATA	#5	#5
LIB30.DATA	#5	#5
DRAWING FILES	#9 (floppy)	#10 (floppy)
LIBRARY FILES	#11 (hard disk)	#10 or #11 (floppy or hard

Q (Quit)	COMMAND: E(dit, ...

Your network system is now completely configured. Each user will boot from the hard disk. Each user must have a formatted diskette in the floppy drive #9 for his workfile and drawing files.

Use the following procedure to logon and execute the drafting program:

At the Constellation logon screen:

You type:	The computer responds:
	USER ID:
CAD30 [return]	Password:
xx [return]	COMMAND: E(dit, ...
X (eXecute)	Execute what file ?
CAD30:2D30 [return]	Two-Dimensional Drafting version 3.0 ... Press [RETURN] to continue

Application note: Conversion of version 2.7 drawing files

CONVERSION OF DRAWINGS FROM VERSION 2.7 TO VERSION 3.0

This document outlines the steps required to convert your Version 2.7 (2.7a) drawing files to the Version 3.0 drawing file format. If you do not need to convert any Version 2.7 (2.7a) drawing files, then simply ignore this procedure and enjoy your new update.

The minimum materials needed for this conversion program are:

a) A standard two disk drive CADAPPLE hardware setup.
b) The following three diskettes:

- The Version 3.0 'BOOT' diskette provided with your drafting system.
- Your Version 2.7 (2.7a) drawing files that need to be converted.
- A newly formatted diskette. This diskette will be used to store the converted drawing files. Refer to the CADAPPLE Installation manual for instructions on disk formatting.

Note: to avoid confusion, do not store converted 3.0 drawings on diskettes with old version 2.7 (2.7a) drawings.

Step (1) CHECK DISK NAMES:

Place the Version 3.0 'BOOT' diskette into volume #4 and the newly formatted diskette into volume #5. Power-up the computer. The APPLE Pascal COMMAND menu will shortly appear on the screen.

At the Pascal COMMAND menu:

You type:	The computer responds:
F (Filer)	Filer: G, S, ...
V (Volumes)	Vols on line: 1 Console 2 Systerm 4 BOOT 5 BLANK
Insert the diskette with Version 2.7 (2.7a) drawing files in volume #5 and press V (Volumes)	Vols on line: 1 CONSOLE 2 SYSTERM 4 # BOOT 5 xxxxxxxx (disk name) The name of the diskette in volume #5 MUST NOT be the same as the newly formatted diskette (BLANK). If it is, change the name of either diskette using the instructions in the Filer section of the Application Notes.
Q (Quit)	COMMAND: E(dit, ...

Step (2) EXECUTE THE CONVERSION PROGRAM

X (eXecute)

Execute what file ?

CONV2.7 [return]

Place V2.7 (V2.7a) and V3.0 diskettes into the appropriate volumes.
Press [RETURN] to continue

Place the diskette containing Version 2.7 (2.7a) drawing files into volume #4 and the diskette to contain Version 3.0 drawing files into volume #5.
Press the [RETURN] key .

CADAPPLE 2D data file conversion program for V2.7 (2.7a) ...
... V2.7 (2.7a) volume # ?

4 [return]
(volume with V2.7 files)

V2.7 (V2.7a) file name ?

xxxxxxxx [return]
(xxxxxxxx is the name of the 2.7 (2.7a) drawing file you want to convert.
Type the same name that the file was saved under using the FILER Save option in the CADAPPLE program.)

V3.0 volume# ?

5 [return]
(volume number of the Version 3.0 drawing file diskette)

V3.0 file name ?
(what you want to call the drawing in Version 3.0. You can either type the same name the drawing had in Version 2.7 or you can give it a new name.

xxxxxxxx [return]
(version 3.0 name)

The program will convert the Version 2.7 (2.7a) drawing file format to the Version 3.0 drawing file format. When the drawing file is successfully converted, the following message will be displayed:
File converted to V3.0
Press [RETURN] to continue

[return]
(convert another file.
Type in the volume number (4) of the Version 2.7 drawing file diskette and continue as in Step (2) above)

If the program outputs any message other than those described above, you probably have your diskettes inserted into the wrong disk drives. Double check your responses to the above questions and verify that the correct diskettes are in place.

This program cannot restore drawing files that are 'damaged' or 'garbaged' due to mishandling or accidental erasure.

PASCAL OPERATING SYSTEM FILER

The operating system you received with your drafting system is a run-time version of the APPLE Pascal V1.1 and it includes:

- the files and programs necessary to boot the system;
- a Filer that allows you to manipulate files in the system;
- a format program which for formatting new diskettes.

The Pascal COMMAND Menu provides access to these operating system features. While these operating system features are not part of the drafting system, it is essential that you be familiar with the capabilities and conventions of the operating system for efficient use of the system. This section is not intended to be a comprehensive reference manual for the APPLE Pascal; it provides only fundamental examples to help you manage your system. For additional information, please refer to 'APPLE Pascal Operating System Reference Manual', 'UCSD p-System Users Manual, Version IV' from SofTech Microsystems, Inc., San Diego, Ca., or other reference books on the UCSD Pascal Operating System.

The operating system Filer is used to:

- get information about the devices and files on the system;
- transfer information from one place to another;
- remove files;
- maintain the disk.

Before discussing the various Filer commands, it is important to understand some of the terminology used by the operating system. APPLE Pascal refers to any input or output device as a 'volume'. These devices include the screen and the keyboard as well as disk drives and printers. The operating system identifies disk drives by unit number and by volume name. If your system has 2 floppy disk drives, the operating system generally refers to them as volumes #4 and #5. If your system has an external hard disk (like a Corvus disk), those devices can have multiple volumes.

NAMING VOLUMES AND FILES

Files are accessed by name. The order and punctuation within the name are important. A filename consists of three parts:

Volume-name (or Unit-Number):Filename.File type

For example:

BOOT:ENVIRO.CODE	(Code of the ENVIRO program on the BOOT disk)
DRAW30:2DJOB1.DATA	(Drawing file from the 2D program named JOB1 on a disk named DRAW30)
#5:2DJOB1.DATA	(Drawing file JOB1 on a disk in drive #5.

VOLUMES are specified using the following rules:
- A volume name may be up to 7 characters long.
- A volume name may include letters, numbers and some special characters.
- Volume name must NOT include '=', '$', '?', ','.
- A volume name or number is always followed by a ':'.
- Reference to unit number is always prefixed by '#' (e.g. #5:)
- Certain other names are already used by the system -- 'CONSOLE', 'SYSTERM', 'PRINTER', 'REMIN', 'REMOUT' and should not be duplicated

WHEN YOU HAVE MORE THAN ONE DISK IN THE SYSTEM, IT IS VERY IMPORTANT THAT THESE DISK HAVE DIFFERENT VOLUME NAMES. The Format program assigns the name 'BLANK' to each disk. You should change the name of each disk to a unique name (to fit your cataloging scheme) using the CHANGE command described below.

Each disk volume has a directory that lists the files in that volume. Files may be code files (programs), data files, text files, or other types of files.

FILES are specified using the following rules:
- A file name may be up to 15 characters including the file-type (examples of file type suffix -- '.TEXT', '.CODE', '.DATA'). The file-type is usually automatically appended by the system.
- A file name may include letters, numbers, and some special characters.
- A file name must NOT include '$', '[', '=', '?', ',', [return], and certain [ctrl] characters.
- File names should not include embedded spaces.
- Two files with the same name cannot appear on the same volume but the name may be duplicated on a different volume.

The Filer menu is listed on 2 lines (type ? to see the second line):

Filer: G, S, N, L, R, C, T, D, Q

Filer: W, B, E, K, M, P, V, X, Z

These letters are the abbreviation for the following features:

Get, Save, New, List (Directory), Remove, Change, Transfer, Date, Quit

What, Bad-block, Ext list, Krunch, Make, Prefix, Volumes, eXamine, Zero.

COMMANDS USED TO GET INFORMATION

Volume lists input and output devices on the system by unit number and volume name.

You type:	The computer responds:
V	(listing of volumes on the system)

All the volumes on the system will be displayed including the CONSOLE and a PRINTER (even if you don't have a printer).

The ROOT VOL is indicated -- on most systems this is volume #4 (the boot volume). The PREFIX VOL is also indicated. The PREFIX volume is the volume that the system 'assumes' if you type in a file name without specifying a volume. When you first boot the system, the PREFIX volume is the same as the ROOT volume. Please see the information below for changing the PREFIX volume.

List Directory lists the files saved on the specified volume.

You type:	The computer responds:
L	Dir listing of what vol ?
#4 [return]	

The files on that volume are listed with their block length and the date last modified. If the number of files is greater than that which fits on one screen, the listing stops. Press the [space] key to see the rest of the files. The last line shows how much room is left on the disk.

Extended-directory lists the directory with more information than the List command.

This command lists the files and the unused areas on the diskette. It also lists the starting address of each file and the file-type. Use this command to see if you have unused fragmented areas on the disk that you can consolidate using the Krunch command. To see the files on drive #5:

You type:	The computer responds:
E	Dir listing of what vol ?
#5: [return]	The files and any unused spaces on unit #5 are displayed.

COMMANDS FOR MOVING FILES

Transfer copies files to another location.

If you have two disk drives, you can copy the whole diskette using the Transfer option in the Filer.

You type:	The computer responds:
'T'	Transfer what file ?
#4: [return] (everything on volume #4)	To where:
#5: [return] (the destination volume)	Transfer 280 blocks ?
Y (to copy the entire disk. To transfer only a few blocks from the beginning of the diskette, type 'N' then the number of blocks)	Destroy BLANK ? (The disk in drive #5 is named BLANK if it is a newly formatted disk; otherwise, the name of the disk is displayed.)
Y (if you want the files from drive #4 to be copied onto the diskette in drive #5. If you have files that you want on the diskette in drive #5, type 'N'.)	(All of the files on drive #4 will be copied to drive #5. The name of the disk will also be duplicated.

Application note: Pascal Operating System Filer

IF YOU HAVE ONLY ONE DISK DRIVE you can copy files from one floppy diskette to another. If you are copying more than one file, it is a rather tedious procedure because you have to swap diskettes several times. To make an exact duplicate of the BOOT diskette onto a newly formatted diskette, be sure that the BOOT diskette is in drive #4

You type:	The computer responds:
T	Transfer what file ?
#4: [return]	To where ?
#4: [return]	Transfer 280 blocks ?
Y	Insert destination disk
Insert the formatted destination disk in #4. [space]	Destroy BLANK: ?
Y	The computer will write to the destination disk then prompt you to put the source disk back in drive #4. Follow the instructions on the screen until the Filer menu line is displayed.

You can copy all the files on one disk to a second disk without destroying what is already on the second disk:

You type:	The computer responds:
T	Transfer what file ?
#4:= [return] (source files are on #4 and you want the computer to copy all the files)	To where:
#5:$ [return] (the destination diskette is in drive #5 and any file copied is to retain the same name)	If the destination disk already has some of the files, it will ask if you want to replace them.
Y or N	

This is a good way to transfer all the files from floppy diskettes to a hard disk because it does not restrict the size of a volume to the size of a floppy disk and it does not rename the hard disk volume.

TO COPY INDIVIDUAL FILES FROM ONE VOLUME TO ANOTHER

Files may be transferred (copied) from one volume to another, to a different name on the same volume, or to a different diskette placed in the same disk drive.

Before attempting to transfer a file, it is a good practice to list the directories of the disk in both the source drive and the destination drive using the List command. THE VOLUME NAMES OF THE TWO DISKETTES MUST NOT BE THE SAME. You should also check that there is enough room on the destination disk for the copy of the file.

To copy an individual file (for example, the 2D30.CODE file) from the boot diskette in drive #4 to another diskette in drive #5

You type:	The computer responds:
T	Transfer what file ?
#4:2D30.CODE [return] (the full name of the source file)	To where ?
#5:2D30.CODE [return]	(the 2D30.CODE file will be copied from the disk in drive #4 to the disk in drive #5.)

To copy several selected files from one diskette to another, you can have the computer display each file name for you to approve or reject. In the following example, the '?' means 'ask me' and the '$' means that the file should keep the same name.

You type:	The computer responds:
T	Transfer what file ?
#4:? [return] (source files are on #4 and you want the computer to display each file for approval.)	To where:
#5:$ [return] (the destination diskette is in drive #5 and any file copied is to retain the same name)	Transfer BOOT:SYSTEM.LIBRARY ? (lists the first file)
Y (if you want the named file copied; N if you don't want it.)	

The computer will display the name of each file in turn and copy those files when you answer 'Y'. When all the files have been copied, the Filer command line will be displayed. It is a good practice to use the List command to display the directory of the destination diskette when all the files have been copied. You should also note the name of the diskette to be sure that is correct for your naming scheme.

COMMANDS FOR DELETING FILES

Remove removes the indicated file name from the directory.

You type:	The computer responds:
R	Remove what file ?
#4:ENVIR030.DATA [return] (You want to remove the ENVIR030.DATA file from drive #4.	Update the directory ?
Y (Confirming that you want the name of the file ENVIR030.DATA removed from the directory.)	

Zero erases the diskette directory

You can use this command to erase the directory on a disk. The disk must be formatted. To zero the directory of a diskette named DRAW2: in disk drive #5

You type:	The computer responds:
Z	Zero dir of what vol ?
#5: [return]	Destroy DRAW2: ?
Y	Duplicate Dir ?
N	Are there 280 blks on the disk?
Y	

COMMANDS FOR MAINTAINING DISKFILES

Change used to change the name of a file or to change the name of a volume.

To change the name of a file:
(to change DRAW:2DABC on drive #4 to DRAW:2DXYZ

You type:	The computer responds:
C	Change what file ?
DRAW:2DABC [return]	Change to what ?
DRAW:2DXYZ [return]	

Use the List command to see that the file name has been changed on drive #4.

To change the name of the volume:
(to change the name of the disk in drive #5 to DRAW1)

You type:	The computer responds:
C	Change what file ?
#5: [return]	Change to what ?
DRAW1: [return]	

The name of the diskette will be changed to DRAW1. Use the List command to see the directory of volume #5.

You could also use the following syntax to change the name of the disk in drive #5 to DRAW1:

You type:	The computer responds:
C	Change what file ?
#5:,DRAW1A: [return]	

The name of the diskette will be changed in one step. Note you must use the ':' after the volume designations.

Bad-Blocks scans the disk for bad areas on the disk.

You type:	The computer responds:
B	Bad block scan of what vol?
#4 [return]	Scan for 800 blocks ? (Y/N)
Y	The computer will check the disk. It will usually respond '0 Bad Blocks'. If it finds any, they will be listed on the screen.

Krunch moves files on the diskette so that there are no fragmented unused spaces between files -- all the unused space is combined at the end. Before you Krunch a disk, it is a good practice to do a bad block scan to make sure that you are not moving files onto a bad area.

To Krunch volume #4:

You type:	The computer responds:
K	Crunch what vol ?
#4 [return]	From end of Disk ? (Y/N)
Y	

You should be careful not to interrupt the computer until the Krunch process is completed. If the system is reset or the disk drive door is opened before the krunch is completed, the last file moved may be unreadable. If SYSTEM.PASCAL is moved, you should reboot the system when the krunch is completed.

OTHER COMMANDS

Prefix allows you to change the volume name that the system 'assumes' if no volume name is specified. The usual prefix is the Boot volume (usually #4). This change is only in effect until the system is rebooted.

Date allows you to tell the system what day it is. The date is associated with any files that you save and is displayed when you list the volume.

Quit leaves the system Filer and returns to the System Menu.

PROBLEMS AND SOLUTIONS

The following is a collection of the most common problems, their most likely causes, and solutions. This list is certainly not exhaustive. If you still have a problem after going through this list, call your dealer or T & W Systems Support.

COMPUTER WILL NOT BOOT UP

CAUSE: 'BOOT' diskette is not in the boot up drive.

SOLUTION: Put the 'BOOT' diskette in the first drive (volume #4 in the Pascal system) and turn the power on. If booting from the hard disk, be sure that the power to the disk is on.

CAUSE: Monitor is not plugged in or connected with computer.

SOLUTION: Be sure that monitor is plugged into live circuit and that the power switch is on. Check that monitor is connected with video output jack on computer.

CAUSE: Disk drive controller card is in the wrong slot.

SOLUTION: The disk controller card for the boot disk drive must be in slot #6 in the computer.

CAUSE: Cable from controller card is not attached or is attached to the wrong floppy drive.

SOLUTION: The cable attaching floppy drive #1 must be firmly connected with connector #1 on the card with pin 1 on the card aligned with the stripe on the cable.

CAUSE: The computer can't read the 'BOOT' disk because the read head is out of alignment or the speed is too fast or too slow.

SOLUTION: Try to boot up with another Pascal diskette, if possible. Try swapping drive #1 and drive #2. Have drive checked and adjusted if necessary.

CAN'T COPY THE MASTER DISK -- MESSAGE 'Volume not on line'

CAUSE: Destination diskette is not formatted correctly.

SOLUTION: Use the system Filer to list the directory of the newly formatted disk. It should say 'BLANK'. If you cannot list the directory, re-format the diskette.

CAN'T MAKE CHANGES IN ENVIRO -- MESSAGE 'Can't write to the disk'

CAUSE: 'BOOT' diskette is write-protected.

SOLUTION: Do not make changes using the Master diskettes. Make copies of all the Master diskettes and work with the copies. Do not put write-protect tabs on the copies.

CAN'T RUN 2D PROGRAM. MESSAGE 'Not enough room for workfile'

CAUSE: Diskette is write-protected.

SOLUTION: Do not attempt to run the 2D program using the Master diskettes. Make copies and work with the copies. Do not put write-protect tabs on the copies.

CAUSE: There is not enough room on the diskette (or on the hard disk volume) to create the workfile.

SOLUTION: Use the system Filer to look at the volume where the workfile is being created to see how much room is unused. (If you are using a hard disk and don't know which volume, execute ENVIRO30 and look at the Alternate menu to see where '2D30.WRK.DATA' is.) You can:

(1) change ENVIRO to put '2D30.WRK.DATA' on a different volume (hard disk only):

(2) reduce the size of the workfile using ENVIRO then remove the existing '2D30.WRK.DATA', if any, using the system Filer. Crunch the volume. Execute the 2D program and a new smaller workfile will be created.

(3) Remove unnecessary files from the work volume.

Application note: Problems and Solutions

DRAFTING PROGRAM DOES NOT RUN -- MESSAGE 'No Digitizer Interface Card'

CAUSE: The T & W Digitizer Interface Card must be in the computer to run the drafting software.

SOLUTION: Install the T & W Digitizer Interface Card in the computer.

DRAFTING PROGRAM DOES NOT RUN -- MESSAGE 'Can't find MESS30.DATA'

CAUSE: The program cannot find the MESS30.DATA file on the volume indicated in ENVIRO.

SOLUTION: Execute ENVIRO and check which volume is supposed to have MESS30.DATA then use the system Filer to list the directory of that volume. If it is missing, you can either transfer MESS30.DATA to that volume or change ENVIRO.

DIGITIZER DOES NOT MOVE THE CURSOR ON THE GRAPHICS SCREEN

CAUSE: ENVIRO has been set to Joystick.

SOLUTION: Execute the ENVIRO program and change Input to digitizer.

CAUSE: Input device has been changed to joystick within the 2D program.

SOLUTION: Go to INPUT and change input device.

CAUSE: Switch settings are incorrect on digitizer.

SOLUTION: The 'Reset' and 'Stream' buttons must both be lit.

CAN'T SAVE THE DRAWING. MESSAGE 'Not enough room ...'

CAUSE: There is not enough room on the diskette or hard disk volume to save the drawing.

SOLUTION: (1) Save the drawing on a different diskette. (2) Delete unwanted drawings off the diskette using the system Filer. Krunch the diskette using the system Filer, then try to save the drawing.

NONE OF THE OBJECTS IS BLINKING IN MODIFY

CAUSE: The 'object tracking' option is not on.

SOLUTION: Turn 'object tracking' on by pressing Function key '&'.

PLOTTER DOES NOT RESPOND AT ALL WHEN A DRAWING IS SENT

CAUSE: Plotter power cable is not connected. Cable from the plotter to the computer is not connected.

SOLUTION: Recheck each connection. Recheck that there is electric power at the outlet. Check that cable from the plotter to the computer is firmly connected at both ends.

CAUSE: Async. serial interface card is in the wrong slot.

SOLUTION: Check which slot the card is in (should be in slot #1 or #2). Execute ENVIRO and set output to that slot.

CAUSE: Wrong Async. interface card.

SOLUTION: Check card -- must be CCS-7710-01 or Apple Super Serial card. Execute ENVIRO and set to match card.

CAUSE: Wrong switch settings on Async card.

SOLUTION: Check switches on card.
CCS-7710 NNNF
Apple Super Serial FFFNNNN NNNNFFF
Triangle on jumper plug pointed to 'Terminal'

CAUSE: Wrong baud rate on plotter.

SOLUTION: Set to 9600 baud. Check switch settings in the Installation Manual.

CAUSE: Wrong plotter driver in program.

SOLUTION: Check the original 'CODE' disk for the plotter driver --
DMPL for Houston Instruments DMP-3 through DMP-7
DMPL+ for Houston Instruments DMP-29, 40, 41, 42
HP for Hewlett Packard
IWATSU for Iwatsu
TEK for Tektronixs

CAUSE: Defective plotter cable.

SOLUTION: Recheck plotter cable -- if it was not ordered from T & W, be sure that it is the correct pin configuration (check Installation Manual).

PLOTTER DRAWS PART OF THE DRAWING THEN STOPS

CAUSE: Defective plotter cable.

SOLUTION: Recheck plotter cable -- if it was not ordered from T & W, be sure that it is the correct pin configuration.

CAUSE: Problem in the drawing.

SOLUTION: Try a different drawing. If the plotter fails on a different drawing, there may be a problem in the plotter. If the problem is only in one drawing and the plotter stops at the same place each time, try deleting the object that it stops on the readd the object.

Application note: Problems and Solutions

PLOTTER LOSES THE EDGES OF THE DRAWING

CAUSE: Edge of the drawing is being clipped by the plot window.

SOLUTION: Be sure that the edge of the drawing does NOT lie exactly on the edge of the screen. In making a plot spec, be sure that the plot window is at least one screen dot c dot outside the outside edge of the drawing.

CAUSE: The plot limit has been set for a large drawing in ENVIRO but the plotter is a smaller plotter.

SOLUTION: Execute the ENVIRO program and set the plot limits to match the plotter in use.

CAUSE: The scale entered for the drawing in entering the plot spec produces a drawing that is larger than the limits of the plotter.

SOLUTION: When selecting a plot scale, consider the ultimate size that the drawing will be. A drawing which is 40 units across on the screen cannot be drawn to a .5 scale on a plotter whose maximum plot limit is 14 inches. It can be plotted to .3 scale.

SOME OF THE OBJECTS IN THE DRAWING DO NOT PLOT

CAUSE: The objects that did not plot may be on a different level.

SOLUTION: Check SWITCHES and be sure that all levels are on. If some are off, turn them on and check the screen to see if the missing objects reappear then replot.

CAUSE: The objects that did not plot may be template objects.

SOLUTION: Check SWITCHES. If Templates is 'N', turn templates to 'Y' and check the screen to see if the missing objects reappear then replot.

DRAWING IS TOO SMALL USING THE DEFAULT PLOT SPEC

CAUSE: The plot limit in ENVIRO is set for a small plotter.

SOLUTION: Execute the ENVIRO program and be sure that the plot limits match the plotter in use.